JPRS 79338

30 October 1981

USSR Report

LIFE SCIENCES

BIOMEDICAL AND BEHAVIORAL SCIENCES

No. 12

FBIS FOREIGN BROADCAST INFORMATION SERVICE

NOTE

JPRS publications contain information primarily from foreign newspapers, periodicals and books, but also from news agency transmissions and broadcasts. Materials from foreign-language sources are translated; those from English-language sources are transcribed or reprinted, with the original phrasing and other characteristics retained.

Headlines, editorial reports, and material enclosed in brackets [] are supplied by JPRS. Processing indicators such as [Text] or [Excerpt] in the first line of each item, or following the last line of a brief, indicate how the original information was processed. Where no processing indicator is given, the information was summarized or extracted.

Unfamiliar names rendered phonetically or transliterated are enclosed in parentheses. Words or names preceded by a question mark and enclosed in parentheses were not clear in the original but have been supplied as appropriate in context. Other unattributed parenthetical notes within the body of an item originate with the source. Times within items are as given by source.

The contents of this publication in no way represent the policies, views or attitudes of the U.S. Government.

PROCUREMENT OF PUBLICATIONS

JPRS publications may be ordered from the National Technical Information Service (NTIS), Springfield, Virginia 22161. In ordering, it is recommended that the JPRS number, title, date and author, if applicable, of publication be cited.

Current JPRS publications are announced in Government Reports Announcements issued semimonthly by the NTIS, and are listed in the Monthly Catalog of U.S. Government Publications issued by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

Correspondence pertaining to matters other than procurement may be addressed to Joint Publications Research Service, 1000 North Glebe Road, Arlington, Virginia 22201.

Soviet books and journal articles displaying a copyright notice are reproduced and sold by NTIS with permission of the copyright agency of the Soviet Union. Permission for further reproduction must be obtained from copyright owner.

JPRS 79338

30 October 1981

USSR REPORT

LIFE SCIENCES

BIOMEDICAL AND BEHAVIORAL SCIENCES

No. 12

CONTENTS

BIOCHEMISTRY

New Data on Metabolism and Action Mechanism of Mycotoxins.......... 1

Hygiene Aspects of Protecting Water Resources in Region of Territorial-Industrial Complexes With Production Facilities Engaged in Organic Synthesis.......................... 2

Study of Antigen Structure and Chemical Composition of Brucella During Process of L-Transformation and Reversion................. 2

Comparative Cytoenzymatic Investigation of Infectious and Vaccine Processes in Experimental Brucellosis............................ 3

Construction of Plasmid Vector for Promoter Cloning................ 4

Restriction Mapping of T4 Bacteriophage Late Gene Region Containing Replication Initiation Points......................... 4

Plasmid ColEI DNA Transcription in Escherichia Coli RNA-Polymerase System.. 5

Sanitation and Hygiene Evaluation of Microbial Preparations Used in Plant Protection... 6

Effectiveness of Water Purification Systems in Modeled Water-Main Purification Systems Used To Remove Organophosphorus Pesticide Transformation Products.. 6

BIONICS

Geometric Body Features and Line Drawings of Two Species of Black Sea Delphinids as Related to Their Hydrodynamic Characteristics... 7

BIOTECHNOLOGY

Variability in Olfactory Behavior in Cimex Lectularius L. as Function of Feeding Conditions.................................. 12

ENVIRONMENT

Relationship Between Body Weight in Mammals and Features of Habitat.. 13

Fleas of Small Mammals in Northern Tayga of South Taymyr........... 14

MEDICINE

Prospects for Using Immobilized Enzymes in Surgery................. 15

Filarial Diseases... 16

MEDICAL DEMOGRAPHY

Demographic Processes and Role of Medical Science and Health Maintenance in Improving Demographic Situation.................... 17

Present Trends in Infant Mortality in European Socialist Countries... 22

PHYSIOLOGY

Time and Information Model of Human Memory Organization............ 23

Otolithic Reflex and Space Perception Function of Cosmonauts....... 34

RADIATION BIOLOGY

Dosimetric Guide-Rule for Calculating Absorbed Doses of Electron Radiation... 39

Comparison of Experimental Gamma-Radiation Installations Using Set of Thermoluminescent Dosimeters.............................. 40

HUMAN FACTORS

Measuring/Computing Complex for Automation of Ergonomic Experiments.. 41

PSYCHIATRY

Mental Phenomena in a Healthy Person Which Resemble the Psychopathological.. 48

PSYCHOLOGY

Psychology: Results, Problems, Experiments........................ 49

UDC 614.31 + 614.7]: 615.918: 582.28

NEW DATA ON METABOLISM AND ACTION MECHANISM OF MYCOTOXINS

Moscow VESTNIK AKADEMII MEDITSINSKIKH NAUK SSSR in Russian No 1, Jan 81
pp 88-95

TUTEL'YAN, V. A. and KRAVCHENKO, L. V., Institute of Nutrition, USSR Academy
of Medical Sciences, Moscow

[Abstract] Recent Soviet and Western research on mycotoxins is reviewed. The metabolism of alphatoxins from the genus Aspergillus is examined, together with the fate of alphatoxin metabolites in the bodies of animals; possible metabolic pathways are described. The important role of various types of toxic metabolites--the ochratoxins--from fungi belonging to the genera Penicillium and Aspergillus is discussed. The threat to health in man and animals presented by the trichothecin mycotoxins is emphasized and the features of the metabolism of these toxins are considered. Results from recent studies of trichothecin toxins and zearalenon (from the genus Fusarium) are summarized. In general, all studies examined in this review indicate that the mycotoxins to one degree or another affect the various stages of protein and nucleic acid synthesis. This apparent pattern may, however, be associated with the greater attention being given by researchers to cellular processes: the biochemical changes that have been found are not specific only for mycotoxins and do not fully explain their biological effect. It is suggested that studies of the effect of mycotoxins on other aspects of cell metabolism, especially in the membrane, could also be fruitful. Figures 9; references 75: 6 Russian, 69 Western.
[324-9642]

UDC 614.777: 628.191: 628.39

HYGIENE ASPECTS OF PROTECTING WATER RESOURCES IN REGION OF TERRITORIAL-INDUSTRIAL COMPLEXES WITH PRODUCTION FACILITIES ENGAGED IN ORGANIC SYNTHESIS

Moscow VESTNIK AKADEMII MEDITSINSKIKH NAUK SSSR in Russian No 1, Jan 81
(manuscript received 29 May 80) pp 22-26

BELYAYEV, I.I., RAKUSHINA, Ye.P. and GRACHEVA, M.P., Gor'kiy Medical Institute

[Abstract] Findings are reviewed from studies conducted over a long period in an area which is a major center of industrial complexes engaged in organic synthesis. This center was developed as early as the thirties and is still undergoing reconstruction. Health-promoting measures have been proposed on the basis of monitoring studies done on the formation of points of contact in the features of liquid-phase effluents, hygiene evaluations conducted on existing purification systems and dynamic studies of the effect of effluents on open water sources and aquifers. Details are given of various water purification systems used to deal with effluent containing multiple organic components. More recent research has shown the presence of some carcinogens in effluent from organic synthesis production facilities in the form of polycyclic aromatic hydrocarbons. Studies have shown that ozonization is the most effective way of removing carcinogens from effluent, and this method is recommended for use in industrial facilities. References 35: 31 Russian, 4 Western.
[324-9642]

UDC 579.841.93: [579.2: 579.253

STUDY OF ANTIGEN STRUCTURE AND CHEMICAL COMPOSITION OF BRUCELLA DURING PROCESS OF L-TRANSFORMATION AND REVERSION

Moscow ZHURNAL MIKROBIOLOGII, EPIDEMIOLOGII I IMMUNOBIOLOGII in Russian,No 7, Jul 81 (manuscript received 18 Jun 80) pp 31-35

DRANOVSKAYA, Ye. A., TOLMACHEVA, T. A. and ROSTOVTSEVA, N. A., Institute of Epidemiology and Microbiology imeni N. F. Gamaleya, USSR Academy of Medical Sciences, Moscow

[Abstract] In connection with the biological changes known to occur in bacteria during the process of L-transformation, a comparative study was made of Brucella during the stage of L-transformation and subsequent reversion. Antigen changes were investigated in Brucella abortus strain 870 and the 870-K24 revertant by determination of "acetone powder" from cultures; yields of the powder from separate cultures of the initial and revertant indicated less intense growth in the revertant. Protein and carbohydrate content were studied using the methods of Lowry, Groeger and Spirin and examination of the UV and IR spectrums. Disk electrophoresis was employed to investigate protein changes in the L-form, and immunoelectrophoresis and double diffusion reaction to elucidate the antigen makeup. Findings showed that considerable changes occur in transformation:

total protein and carbohydrate are lowered, the content of high-molecular fractions falls, there is loss of lipopolysaccharide, and serologic activity is reduced. In reversion, the antigen structure and chemical composition are not fully restored; this correlates with the reduced serologic and toxic activity of the revertant compared with the initial strain. Figures 4; references 12: 6 Russian, 6 Western.
[538-9642]

UDC 616.98: 579.841.93]-092.9-07: 616.153.1-074

COMPARATIVE CYTOENZYMATIC INVESTIGATION OF INFECTIOUS AND VACCINE PROCESSES IN EXPERIMENTAL BRUCELLOSIS

Moscow ZHURNAL MIKROBIOLOGII, EPIDEMIOLOGII I IMMUNOBIOLOGII in Russian No 7, Jul 81 (manuscript received 13 Nov 80) pp 63-66

SAFRONOVA, V. M., LOKTEV, N. A., AFANAS'YEV, Ye. N., TARAN, I. F. and LUNINA, Ye. A. Scientific Research Antiplague Institute of the Caucasus and Transcaucasus, Stavropol'

[Abstract] A comparative study was made of cytoenzymatic activity in the infection and immunization stages of experimental brucellosis in guinea pigs using two strains of Brucella abortus, namely vaccine strain No 19 and virulent strain No 544. Cytologic examination, leukocyte counts, and passive hemagglutination tests were done on blood taken at various periods up to 180 days after infection or vaccination. Determinations were made of acid and base phosphatase and esterase. In the immunized animals, increased esterase and acid and base phosphatase was observed up to 120 days from the start of the experiment, together with an increased percentage of enzyme-bearing lymphocytes. The virulent Brucella strain induced higher levels of all activity for longer periods. Thus, the changes in enzyme activity in experimental brucellosis as found in neutrophils and lymphocytes depend on the periods of infection and the formation of immunity. Changes in T- and B-lymphocytes are found in both infected and immunized subjects as a function of the immune-allergic restructuring. Comparative studies of enzyme activity can be used as additional differential tests in evaluating the nature of the infection and immunization processes. Figures 1; references 15: 11 Russian, 4 Western.
[538-9642]

UDC 547.963.3

CONSTRUCTION OF PLASMID VECTOR FOR PROMOTER CLONING

Moscow MOLEKULYARNAYA BIOLOGIYA in Russian Vol 15, No 4, Jul-Aug 81
(manuscript received 4 Jun 80) pp 950-955

RECHINSKIY, V. O., SAVOCHKINA, L. P. and BIBILASHVILI, R. Sh., Institute of
Molecular Biology, USSR Academy of Sciences, Moscow

[Abstract] A new plasmid vector, designated pBRS188, was constructed for cloning, selection and amplification of DNA fragments containing promoters for E. coli RNA polymerase. Starting material, plasmid pBRS322, was cleaved with HindIII restrictase in the promoter gene for tetracycline resistance and hydrolyzed with DNA polymerase I in the presence of dGTP to remove nucleotides from the 3' ends of both chains up to the first guanine. The unpaired sections of the 5' ends were removed with S1 nuclease and the ring reclosed with DNA ligase. Structure of the plasmid was confirmed by restriction analysis. To demonstrate the utility of the new plasmid a section of the lac-operon of pOPI was incorporated into it. EcoRI cleavage of pOPI, isolation of the fragment containing the promoter-operator on a Biogel column and further cleavage with AluI restrictase to a segment 94 pairs long were used to prepare the insert. The pBRS188 plasmid was cleaved with EcoRI, the sticky ends filled in with DNA polymerase I in the presence of dATP and dTTP and the promoter fragment inserted with DNA ligase. Half of the recombinants obtained had the Tc^R phenotype, the other half Tc^S, corresponding to the two insertion orientations possible. The data show that the removal of 13 base pairs from pBRS322 gives a plasmid with an inactivated tetracyclin resistance promoter, the reactivation of which can be used to select promoter-containing DNA fragments. The degree of resistance to the drug can measure promoter effectiveness. In addition, treatment of a DNA fragment with DNA polymerase I in the presence of substrate, followed by nuclease SI, permits regeneration of restriction endonuclease recognition sites at the junction of DNA fragments. Figures 4; references 9 (Western).
[300-12126]

UDC 576.858.9;577.22

RESTRICTION MAPPING OF T4 BACTERIOPHAGE LATE GENE REGION CONTAINING REPLICATION INITIATION POINTS

Moscow MOLEKULYARNAYA BIOLOGIYA in Russian Vol 15, No 4, Jul-Aug 81
(manuscript received 18 Aug 80) pp 883-893

KRUTILINA, A. I., PRYTYSYUK, G. G., AYTNER*, G., TANYASHIN, V. I. and
BAYEV, A. A., Institute of Biochemistry and Physiology of Microorganisms, USSR
Academy of Sciences, Pushchino, Moscow Oblast; Institute of Genetics and Plant
Cultivation, GDR Academy of Sciences, Gatersleben

[Abstract] Phage T4 DNA structure in the late gene region was studied by cloning the fragments resulting from the use of EcoRI, HindIII, SmaI, SalI and

BamHI restriction enzymes into HindIII lamda vector 761. The molecular mass of the DNA fragments was determined from their mobility in agarose or polyacrylamide gel electrophoresis. The recombinants were checked for the presence of supF gene by colony appearance and genetically identified via recovery of markers from coinfection with amber T4 mutants. This work permitted listing of the restrictase recognition site coordinates for ten recombinants from vectors 596 and 761 and a corresponding restriction map of genes 5-54. Some previously published map fragments were shown to be in the reverse orientation, others were verified. The site of the BamHI restrictase recognition was established as gene 8. Double cleavage with EcoRI and HindIII located the BglII and XhoI sites and the absence of KpnI and SclI sites. Figures 4; references 19: 2 Russian, 17 Western.
[300-12126]

UDC 547.963.3

PLASMID ColEI DNA TRANSCRIPTION IN ESCHERICHIA COLI RNA-POLYMERASE SYSTEM

Moscow MOLEKULYARNAYA BIOLOGIYA in Russian Vol 15, No 4, Jul-Aug 81
(manuscript received 5 May 80, after revision 9 Sep 80) pp 768-777

DENISOVA, L. Ya., ZAGREBEL'NYY, S. N., KILEVA, Ye. V., PUSTOSHILOVA, N. M. and FILIPPOV, V. A., Special Bureau for the Design and Technology of Biologically Active Substances, Main Administration of the Microbiological Industry of the USSR Council of Ministers, Novosibirsk

[Abstract] Plasmid ColEI DNA transcription by E. coli RNA-polymerase was studied in vitro using electrophoresis, restrictases, ^{14}C or ^{32}P labeled RNA and filtration with nitrocellulose membrane filters. It was shown that maximal RNA synthesis occurs with 10 mM $MgCl_2$ and 50 mM KCl, while 1mM $MnCl_2$ inhibits the reaction. Addition of glycerin to 15 volume % increased the effectiveness of RNA synthesis and gave a product identical to that produced without glycerin. Increasing the ratio of RNA polymerase to DNA template from 5:1 to 20:1 led to symmetrical, nonspecific transcription. The initiating nucleotide was GTP. Electrophoresis demonstrated that RNA, containing 1700 and 110-140 nucleotides, as well as RNA of length similar to the template, were synthesized. Self-hybridization and hybridization with heavy and light DNA indicated that only the heavy strand is transcribed with the low enzyme to template ratio. Hybridization with the BsuRI DNA fragment showed that only the colicin E1 gene was not transcribed. Mitomycin C had little effect and chloroamphenicol no effect on RNA synthesis. Autoradiography revealed that very small amounts of the HaeIIIB fragment transcript were formed in the presence of mitomycin C. Four fragments of the HaeIII digest had affinity for RNA polymerase in the absence of nucleotide triphosphates and two in their presence. These form ternary complexes with the enzyme and the synthesized RNA, indicating the presence of strong promoters in them. The data also reveal a promoter in the HaeIIIF and HaeIIIH region. The direction of in vitro transcription corresponds to that of colicin EI synthesis in vivo. Figures 6; references 32: 6 Russian, 26 Western.
[300-12126]

UDC 615.285.7: 576.8.095.38].033: 614.7

SANITATION AND HYGIENE EVALUATION OF MICROBIAL PREPARATIONS USED IN PLANT PROTECTION

Moscow GIGIYENA I SANITARIYA in Russian No 12, Dec 80 (manuscript received 28 Feb 80) pp 9-11

OMEL'YANETS, T. G. and PADALKIN, V. P., candidates of medical sciences, All-Union Scientific Research Institute of Hygiene and Toxicology of Pesticides, Polymers and Plastics, Kiev; All-Union Scientific Research Biotechnical Institute, Moscow

[Abstract] The possible adverse effects stemming from the use of microbial agents used for plant protection with respect to ecological damage and health hazards in man dictate the need for hygiene standards to be established in the use of these agents. The approach should be made by assessing microbial potential to cause disease. In this connection, mere evaluation of the toxicity of such agents is inadequate for hygiene purposes. It is suggested that a better approach would be assessment of the agent's pathogenicity determined from the "pathogenic dose" used as the measure of the number of microorganisms required to successfully challenge the normal functions of a host. When developing these plant protection agents, careful consideration should be given to all the possible ways in which they might affect man. The following indexes should be considered in evaluating the status of these agents: infectivity, toxicity, allergy potential and antagonist action of the agent with respect to the human host's normal microflora. References 6: 4 Russian, 2 Western.
[328-9642]

UDC 614.777: [628.191: 615.285.7]: 628.16

EFFECTIVENESS OF WATER PURIFICATION SYSTEMS IN MODELED WATER-MAIN PURIFICATION SYSTEMS USED TO REMOVE ORGANOPHOSPHORUS PESTICIDE TRANSFORMATION PRODUCTS

Moscow GIGIYENA I SANITARIYA in Russian No 12, Dec 80
(manuscript received 1 Apr 80) pp 6-9

SHTANNIKOV, Ye. V., professor, and YELISEYEV, Yu. Yu., Saratov Medical Institute

[Abstract] Water purification installations were modeled in order to study their effectiveness in removing contaminating products of organophosphorus pesticides (Malathion and trichlorometaphos-3). Proceeding from the premise of the high stability of organophosphorus breakdown products and their adverse ogranoleptic and toxic properties, a comparison was made between the methods of chlorination and filtering via activated charcoals. It was found that chlorination is ineffective in removing organophosphorus breakdown products from water, and in some cases even increases water odor. The use of activated charcoals (types BAU and SKT with a filter layer of 450 to 500 mm of 1.5-2.7 mm granules) led to reduced toxicity and improvement of organoleptic properties of the water. Figures 2; no references.
[328-9642]

UDC: 599.533.599.537

GEOMETRIC BODY FEATURES AND LINE DRAWINGS OF TWO SPECIES OF BLACK SEA DELPHINIDS AS RELATED TO THEIR HYDRODYNAMIC CHARACTERISTICS

Moscow BYULLETEN' MOSKOVSKOGO OBSHCHESTVA ISPYTATELEY PRIRODY: OTDEL BIOLOGICHESKIY in Russian Vol 82, No 2, Mar-Apr 77 pp 62-66

[Article* by V. D. Burlakov, Zh. Ya. Grishanskaya and V. Ye. Sokolov]

[Text] The question of optimizing the shape of bodies that move in water, from the standpoint of minimal hydrodynamic resistance with retention of the necessary or specified net volume, is still a pressing one in hydromechanics. In this respect, it is of considerable interest to study the geometric [dimensional] characteristics of some marine mammals that swim within a specific range of Reynolds numbers--Re--close to the Re range of some mechanical equipment ($Re = \upsilon \cdot L/\nu$, where υ is the velocity, L is typical linear dimension, for example body length, and ν is the kinematic viscosity coefficient of water). It should be stated that the restriction imposed on this problem by the narrow range of Reynolds numbers ensues from the results of studies of different marine animals and fish, as well as models thereof: there is no universal optimum body shape adapted to different conditions of life and movement. Each shape known at the present time is desirable for only a specific range of Reynolds numbers corresponding to conditions of existence and movement of a given living object. In this respect, dolphins of different species, pinnipeds and some shark species are rather similar to one another among marine mammals and fish. All of them move within a relatively narrow range of Reynolds numbers, $Re \approx 10^7$, and as a result the geometry of their bodies is characterized by similar distinctions.

The line drawing and geometric characteristics of the Black Sea bottlenosed dolphin (Tursiops truncatus) were studied by us previously (Sokolov et al., 1972). Here, we are submitting the line drawings and discussing the geometric characteristics of two other species of Black Sea delphinids--the common dolphin (Delphinus delphis) and porpoise (Phocaena phocaena). The methods used to measure the animals and make line drawings on the basis of obtained data were analogous to those described previously (Sokolov et al., 1972).

Figures 1 and 2 illustrate line drawings of the two Black Sea delphinids, while the Table lists the main geometric characteristics of these animals. All of the characteristics are reduced to a dimensionless form, i.e., referred to the typical linear dimension (L_k--length of body without rostrum, L_g--overall length of the animal's body). For the sake of convenience of comparison, we included in the Table the corresponding characteristics of the common bottlenosed dolphin.

---

*The editorial board expresses its appreciation to N. V. Kokshayskiy for his assistance in preparing this article for publication.

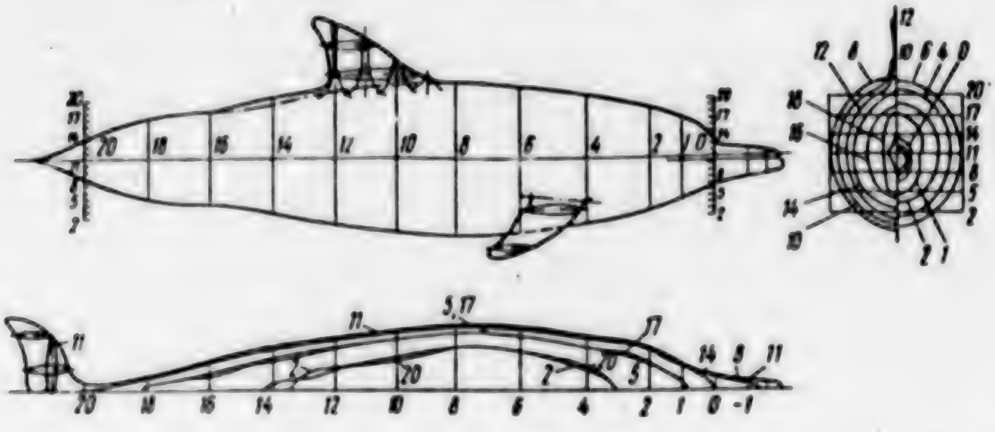

Figure 1. Line drawing of common dolphin. Explanation given in the text.

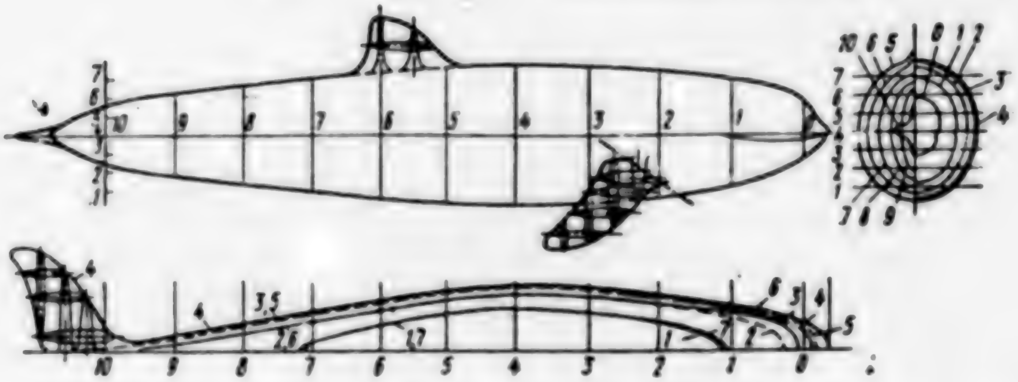

Figure 2. Line drawing of porpoise. Explanation given in the text.

Analysis of the line drawings and figures listed in the Table enabled us to determine that all three species of Black Sea delphinids are characterized by the following main distinctions of geometric body shape: tapered contour of the front of the body, absence of cylindrical part in the middle of the body; elongation in the range of $\lambda = 5$-5.5 or, in other words, relative maximum thickness $d/l = 0.18$-0.2, abscissa of maximum thickness is 0.4-0.5 away from the rostrum.

Each of these features should probably be significant to optimization of shape—to obtain the necessary net volume with minimal hydrodynamic resistance.

In order to determine the role of the tapered outline of the rostral part of the animals' body, we can use the following data (Hertel, 1967). Three solids of revolution were studied, which all had the same relative thickness $d/l = 0.12$: a) solid with cylindrical insert occupying 45% of the length of the entire body, blunt rostral and smoothly tapering rear extremities; b) solid with close to elliptical rostral profile, without cylindrical insert; c) solid with close to parabolic rostral profile, i.e., more pointed, also without a cylindrical insert (Figure 3). The Reynolds number for each of these solids [bodies] constituted $Re = 10^6$.

Main geometrical characteristics of common, bottlenosed dolphins and porpoise

Parameter	Symbol	Common dolphin	Porpoise	Bottle-nosed dolphin
Length of rostrum	$\frac{L_p}{L_k}$	0,092	—	0,05
Length of tail fin	$\frac{L_{xb}}{L_k}$	0,11	0,13	0,104
Maximum height of body (without dorsal fin)	$\frac{H}{L_g}$	0,215	0,176	0,209
Maximum width of body	$\frac{B}{L_g}$	0,191	0,16	0,175
Elongation	$\lambda = \frac{L_k}{B}$	5,23	5,04	5,0
Ellipticity	$\frac{B}{H}$	0,89	0,91	0,834
Area of tail fin	$\frac{S_{xb}}{L_k^2}$	0,0115	0,021	0,023
Area of dorsal fin	$\frac{S_{cn}}{L_k^2}$	0,00847	0,00676	0,0113
Area of pectoral flipper	$\frac{S_{zp}}{L_k^2}$	0,0076	0,00965	0,007
Area of wet surface of body and rostrum	$\frac{\Omega}{L_k^2}$	0,432	0,445	0,520
Area of maximum midsection	$\frac{S_m}{L_k^2}$	0,0338	0,0429	0,0378
Full displacement	$\frac{V}{L_k^3}$	0,017	0,016	0,0218
Abscissa of position of maximum with including beak	$\frac{X_B}{L_g}$	0,426	0,404	0,410
Angle of inclination of dorsal fin in relation to horizontal plane	$\alpha°$	34	39	36

A comparison of the epures of distribution of pressure over the surface of these solids shows that the third one with the tapered "parabolic" rostral outline has definite advantages. The area of negative pressure gradients in it occupies 0.5 of its length, and both a drop and elevation of pressure in the aft part occur smoothly, whereas in the "cylindrical" and "elliptical" solids the minimum pressure peak is at 0.15 of body length, counting from the beak [rostral tip] and subsequent increase in pressure occurs rather abruptly. As is known in hydromechanics, these findings indicate that the streamline section of the boundary layer on the "parabolic" solid is long and there are no separations of the boundary layer, which perhaps does occur on the other two solids. In other words, the hydrodynamic resistance of the "parabolic" solid may be lower than that of the "cylindrical" and "elliptical" solids. The fact that the tapered rostral outline is a sign inherent in objects that move at significant speed ($Re \approx 10^7$) is confirmed in biology on the example of the trout. Having the same relative thickness as swiftly swimming mammals and fish but a much blunter nose, close to elliptical in shape, the trout moves at $Re < 10^5$, i.e., lower by a factor of at least 10^2 than for objects with a tapered nose.

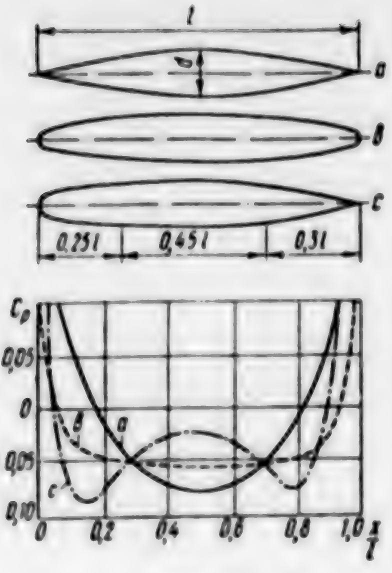

Figure 3.
Comparative distribution of pressure on three solids of revolution of the same relative thickness $d/l = 0.12$. Y-axis, pressure coefficient; x-axis, relative distance from anterior point of body. Explanation given in the text

The role of relative maximum thickness or elongation of solids [bodies], which is the same thing, had been mentioned previously (Hertel, 1966). The relative maximum thickness of Black Sea delphinids--common and bottlenosed dolphins, and porpoise--conforms quite well with the same body characteristics of other swift marine mammals and fish. Thus, the blue whale has a maximum relative thickness of $d/l = 0.21$, the bowhead whale 0.26, different species of sharks 0.14-0.18, swordfish 0.24, tunny 0.22-0.23 (Beier, Glass, 1969) and fur seal 0.21. These data confirm the previously mentioned thesis that the bodies of various swfit-swimming living objects ($Re \approx 10^7$) have a maximum relative thickness in the range of 0.17-0.24. Apparently, it can be assumed that these levels characterize the most desirable shapes of bodies that developed as a result of long-term evolution. Interestingly enough, there is a great resemblance that is demonstrable in schematized profiles of the longitudinal sections of marine mammals and fish, when compared to the profiles known in engineering that have a buoyancy [lifting capacity] (Hertel, 1966).

To describe the net volume of the solids under discussion, we can use a coefficient such as:

$$\eta = \frac{V^{2/3}}{\Omega}$$

where V is total displacement or volume of solid, Ω is the area of wet body surface. In addition, coefficient $K = \eta/c_x$, where c_x is the coefficient of hydrodynamic resistance $X/\rho v^2/_2 \cdot V^{2/3}$, can serve as a parameter characterizing the objects under study from the standpoint of correlation between hydrodynamic resistance and net volume.

The values of shape coefficient η and coefficient $K = \eta/c_x$ for the three species of Black Sea delphinids, two solids of revolution with cylindrical insert and close to elliptical rostral part and the solid of revolution of parabolic outline of the rostral part and without a cylindrical insert are:

	λ	$\eta = \frac{V^{2/3}}{\Omega}$	$K = \frac{\eta}{c_x}$
Bottlenosed dolphin	5,72	0,150	5,0
Common dolphin	5,23	0,154	5,14
Porpoise	5,04	0,126	4,2
Solid of revolution with small cylindrical insert	8,3	0,107	3,56
Solid of revolution with large cylindrical insert	9,7	0,102	3,41
Solid of revolution with parabolic rostral part (according to Hertel, 1967)	4,5	0,160	5,34

In calculating coefficient K, we took 0.03 as the value of C_x, which is consistent with the results we obtained in tests in a wind tunnel with a solid model of a bottlenosed dolphin and solids of revolution with cylindrical insert.

According to the indicated figures, solids with an outline profile close to the profile of the bodies of swift marine mammals and fish are definitely superior. In other words, solids with a "parabolic" rostral outline having no cylindrical insert, the relative maximum thickness of which (d/l = 0.17-0.24) is located at a distance of 0.4-0.5 of body length can be considered to be the best adapted to move in the range of Re = 10^7, from the standpoint of retaining the maximum possible net volume with low hydrodynamic resistance.

BIBLIOGRAPHY

1. Sokolov, V. Ye., Burlakov, V. D. and Grushanskaya, Zh. Ya., "Line Drawing of Black Sea Bottlenosed Dolphin," BYUL. MOIP, OTD. BIOL., Vol 77, No 6, 1972.

2. Hertel, H., "Structure, Form, Movement," New York, 1966.

3. Idem, "Biologisch-technische Forschungen Uber Stromungstechnische Optimale Formen," VDI-ZEITSCHRIFT, Vol 109, No 19, 22, 1967.

4. Beier, W., and Glass, K., "Bionics--Science of the Future," Berlin, 1969.

COPYRIGHT: Izdatel'stvo Moskovskogo universiteta, Byulleten' MOIP, 1977

10,657
CSO: 1C40/347

UDC 595.754: 591.51: 576.8.095.3

VARIABILITY IN OLFACTORY BEHAVIOR IN CIMEX LECTULARIUS L. AS FUNCTION OF FEEDING CONDITIONS

Moscow ZHURNAL OBSHCHEY BIOLOGII in Russian Vol 41, No 6, Nov-Dec 80
(manuscript received 5 Mar 79) pp 940-942

LEVIN, N. A., Zhornovskaya Forestry Testing Station, Belorussian Scientific Research Institute of Forestry, Osipovich City, Mogilevskaya Oblast

[Abstract] An experimental comparison was made of general activity and the level of olfactory response in groups (30 individuals) of Cimex Lectularius L. as a function of hunger. The work was done with the OK-8 8-channel olfactometer using a procedure that insured exact reproducibility throughout the series of experiments. Four experimental situations were studied: 1) a group of insects was fed one day before olfactometric stdies and then starved for each of the subsequent 10 days of olfactometry; 2) a group of insects was fed daily for 10 days and olfactometric studies were done each day; 3) a group was fed the day before a 10-day fast and olfactometric studies were done at the end of the period; 4) a group was fed daily for 10 days and then olfactometric studies were done. The findings indicated that hunger lowers the general level of activity in the insects and increases mortality while enhancing olfactory responses; the effects were increased when the hunger was also combined with irritation. Figures 2; references 4 (Russian).
[327-9642]

ENVIRONMENT

UDC 599: 578.087.75

RELATIONSHIP BETWEEN BODY WEIGHT IN MAMMALS AND FEATURES OF HABITAT

Moscow ZHURNAL OBSHCHEY BIOLOGII in Russian Vol 41, No 6, Nov-Dec 80
(manuscript received 26 Apr 78) pp 879-888

KHANIN, M. A. and DORFMAN, N. L., Moscow Institute of Aviation Technology
imeni K. E. Tsiolkovskiy

[Abstract] Results are presented from a theoretical study of energy available in the bodies of warm-blooded animals as a function of ecologic conditions in the habitat. The energy balance is calculated from the formula

$$P_{max} = \left(\frac{\gamma\beta\eta_{Cy}}{\alpha}\right)^{3/2}$$

where P_{max} is the theoretical maximum energy possible for the body weight of an individual; y is average density of fodder, i.e., the weight of fodder per unit area of the community habitat of a given species of animal; C is the average effective calorific value of food; β is the species-specific coefficient taking account of the features of the geometric shape of the animal's body, the method of obtaining food and the degree to which the fodder base is utilized; α is the mechanical work done by an individual to move one unit of its own weight one unit of distance; η is the average efficiency of the animal's muscles; and γ a factor that here, for the sake of brevity, replaces the function of several parameters characterizing the physiological and ecologic features of the species. The formula is used to demonstrate good agreement between theoretical and empirical findings and the general rule is established that given the same conditions, the maximum body weight of mammals increases in inverse ratio to the proportional coefficient of drag in movement by a factor of 3/2. Figures 6; references 18: 11 Russian, 7 Western.
[327-9642]

UDC 576.895.7

FLEAS OF SMALL MAMMALS IN NORTHERN TAYGA OF SOUTH TAYMYR

Novosibirsk IZVESTIYA SIBIRSKOGO OTDELENIYA AKADEMII NAUK SSSR: SERIYA
BIOLOGICHESKIKH NAUK in Russian No 5, Issue 1, Apr 81
(manuscript received 25 Apr 80) pp 96-104

SAPEGINA, V. F., YUDIN, B. S. and YUDINA, S. A., USSR Academy of Sciences
Novosibirsk Branch Biological Institute, Novosibirsk

[Abstract] Although only 11 flea species have been recorded in the Taymyr, a number of zoonotic diseases including tick-borne encephalitis, tularemia, etc., have also been recorded in this area. This prompted a study of fleas in the area of the Khantaysk reservoir in the northern tayga of the South Taymyr between July and October 1979. Parasitologic studies were done on 772 wild animals belonging to 14 species and carrying a total of 1,434 individuals from 11 flea species. The following flea species were found: Ceratophyllus (Megabotris) rectangulatus, C. (Amalareus) penicilliger, C. (Ceratophyllus) garei, Amphisylla sibirica sibirica, Leptopsylla (Peromyscopsylla) bidentata, and Doratopsylla (Corrodopsylla) birulai; and also, five species recorded here for the first time: Amphalius runatus, Ctenophyllus armatus, Rhadinopsylla (Rectofrontia) integella casta, Catallagia ioffi, and Catallagia dacenkoi. The seasonal activity, distribution on hosts and features of the flea population are described. About 75 percent of the fleas studied showed similarities to the fleas found in North America. References 28: 27 Russian, 1 Western.
[364-9642]

UDC 615.355.03: 617

PROSPECTS FOR USING IMMOBILIZED ENZYMES IN SURGERY

Moscow SOVETSKAYA MEDITSINA in Russian No 1, Jan 81
(manuscript received 17 Apr 79) pp 92-94

VEREMEYENKO, K. N., TOLSTYKH, P. I. and VASIL'KOVA, Z. F., Department of General Surgery, First Moscow Medical Institute imeni I. M. Sechenov; Biochemistry Laboratory at the Kiev Scientific Research Institute of Otolaryngology

[Abstract] Recent developments in the use of immobilized enzymes in surgery are reviewed. The problem of finding biologically suitable matrices to carry the enzymes now appears largely solved: polysaccharides and proteins are best suited, and recently liposome has also been successfully used as the carrier. The main applications of immobilized enzymes in surgery are briefly described and the prospects for their use in enzyme therapy for various purulent inflammatory processes are examined. Soviet studies on the possible use of trypsin for wound repair are described; experimental work with rabbits has demonstrated this enzyme's usefulness in reinforcing repair processes. Soviet and Western work with plasmin and plasminogen activators has indicated their significance in thrombus lysis, although certain disadvantages still need to be overcome. The prospects for using immobilized enzymes for developing thrombus-resistant materials appear good; Soviet researchers are actively working in this area. The role of immobilized enzymes in eliminating toxic products is mentioned. Another avenue of research being pursued by Soviet researchers is the use of immobilized enzyme inhibitors, particularly the use of proteolytic enzyme inhibitors in pathologic processes associated with proteolysis and fibrinolysis activation. In other applications, immobilized enzymes are being used as chemical reagents to assay biological compounds and metabolites in biological fluids; this method is highly sensitive in determination of glucoses and urea. References 19: 13 Russian, 6 Western.
[326-9642]

UDC 616.995.132.5

FILARIAL DISEASES

Moscow ARKHIV PATOLOGII in Russian Vol 43, No 5, May 81
(manuscript received 9 Sep 80) pp 32-35

ARUTYUNOV, V. D. and VISHNYAKOV, A. Yu., Scientific Research Institute of Labor Hygiene and Occupational Diseases, USSR Academy of Medical Sciences, Moscow

[Abstract] A description is given of filarial diseases (wuchereriasis and onchocerciasis) encountered during work in the countries of tropical Africa. These diseases typically affect 10 to 25 percent of the populations of Africa, Southeast Asia and Central America. Eight viviparous filarial helminths are known to affect man: Wuchereria bancrofti, Brugia timori, Onchocerca valvulus, Loa Loa, Mansonella ozzardi, Tetrapetalonema (Dipetalonema) perstans, Tetrapetalonema (Dipetalonema) streptocarca and Brugia malayi (Dissanaike). Observations of loiasis caused by Loa extraocularis Scrjabin and Dirofilaria repens Railli et Hanry have been described in the Soviet Union. The epidemiology, clinical picture and pathological anatomy of wuchereriasis and onchocerciasis are described. A special feature in the development of these diseases in East Africa is frequent occurrence of hydroceles, which could be one cause for the low birth rate in this area. Since the clinical picture in these diseases is frequently atypical, a firm diagnosis can be made only on the basis of morphologic studies. Figures 2; references 9: 3 Russian, 6 Western.
[378-9642]

UDC 614.1:312

DEMOGRAPHIC PROCESSES AND ROLE OF MEDICAL SCIENCE AND HEALTH MAINTENANCE IN IMPROVING DEMOGRAPHIC SITUATION

Moscow SOVETSKAYA MEDITSINA in Russian No 7, Jul 81
(manuscript received 27 Nov 80) pp 81-84

[Article by Professor M. S. Bednyy, Republic Scientific-Research Laboratory for Medical Demography of the RSFSR Ministry of Health, Moscow]

[Text] Demographic factors have a definite influence on many of the processes in social-political and social-economic life in the modern world. Problems of population and nature management, which have become pressing in recent years, were discussed at the 25th CPSU Congress. Demographic problems have been considered broadly in the periodic press, and a large number of monographs and thematic collections have been devoted to them.

However, demographic patterns have still not been explained to the degree needed from the viewpoints of medicine and health maintenance, and the interdependence of these phenomena has not been considered. There is insufficient foundation for the directions of the activity of health maintenance and scientific medical research in the area of resolving medical and demographic aspects--one of the most urgent problems of the present day.

The fact is that during the post-war period (late 1950s and early 1960s), the structure and dynamics of the population changed from that existing before the war; it began to differ in terms of many demographic characteristics. The reduction in the birthrate and changes in generational structure, urbanization and redistribution of the population between the country and the city, increasing migrational flows from year to year, the aging process of the entire population and of that sector which is able to work, changes in the ratio of newborns in terms of their order of birth and the age structure of mothers giving birth to their first and subsequent children, and changes in the ratio of men to women in different age groups, are affecting the status of health of the population. If we consider that there have been, in parallel with demographic shifts, changes in the social and occupational structure of the population, the level of its education, sophistication, psychology and so-called demographic behavior, it becomes clear that health maintenance will be able to achieve superior results only if account is taken of the social and demographic shifts occurring in the country.

Measures taken by public health agencies aimed at preserving and strengthening the health of the population have an effect on the nature and dynamics of demographic processes. In turn, the shifts in demographic processes and changes in the social, production and occupational structure of the population, which have come about in the past 10 years, are affecting many indicators which characterize the state of health of the population.

Demographic problems have taken on particular importance for the Russian Federation. The past 10 years have been characterized by significant shifts: the aging process of the population is intensifying, with 20% or more of the residents in many administrative territories being 60 years of age and older.

More than half of all newborns in the RSFSR are first-born; less than 1/3 are second children, and only 1/10 are third or later children. Considering that about 10% of families are childless either because of primary or secondary sterility, or because of a conscious desire not to have children, the birthrate problem, particularly in the central oblasts of the Russian Federation, is becoming extremely acute and requires the tireless attention of public health organs and institutions, scientific workers and medical society.

An undesirable trend in the demographic indicators in the rural population continues to exist throughout the RSFSR: child and overall mortality, mortality due to trauma, accidents, poisoning and cardiovascular ailments is increasing somewhat; increased migrational mobility is also being noted, which results in a change in the age and sex composition of the rural population.

In recent years, rural residents have had worse health indices than urban dwellers, while this relationship was the opposite in the preceding decade.

No adequate correspondence has been observed in the past 10 years between the increasing material and personnel resources of public health, on the one hand, and changes in the state of health and demographic indicators, on the other. The reasons for this phenomen include shifts in the occupational, social and age-sex composition, the increasing migrational mobility of the population, changes in the parturient contingent of women, lack of synonymity in social-demographic characteristics of the generations represented in today's population, population-genetic shifts and a number of other objective factors.

However, the influence of these objective factors cannot be an insurmountable obstacle to improving effective public health activity: the problem is to allow for these factors in current long-term health maintenance plans. It is useful to divide the tasks involved in improving health indicators and improving the demographic situation into two groups. First, it must be determined which health indicators and demographic processes can be influenced directly by public health agencies and institutions; second, it must be determined which of them are not directly associated with health maintenance activity.

The planning of public health personnel, socialization of medical assistance, activation of the activity of uchastok [local sector] medical service, carrying on scientific research and many other public health measures must be based on consideration of the demographic situation.

The study of population problems requires a multi-plan systems approach; the social-hygienic aspect of research presupposes studying qualitative shifts in the population from the viewpoint of its health, labor activity and longevity.

Besides the economic level, the health level of the population is of universal human social and hygienic importance. The fact that the condition of human health is determined by the influence of a complicated system of social and economic factors interacting with the biological regularities inherent in man is well known, and is supported by statistical data. The health of the population is determined by the level of material wealth, social relationships, development of public health, genetic factors, and working, living and food conditions.

The variety of factors which influence the health status of the population makes it extremely difficult to estimate integrally. It is determined to a great extent by the fact that individual age, sex and occupational groups have their own inherent social and hygienic singularities which determine various health indicators.

The health of the population has now become more complicated to measure quantitatively because of the divergence in the indicators which characterize it. Some explanatory examples follow. At the beginning of this century, the high frequency of infectious and parasitic diseases resulted in high mortality and low average life expectancy. This relationship has always existed, but now the situation has been changed completely. In connection with the increased portion of the population of individuals of advanced age who suffer from various chronic ailments which have not had lethal consequences over a period of many years, the mortality and average life expectancy do not show the directions which the morbidity materials evidence. Mortality can be lowered when the morbidity indicators and accumulated contingents of the chronically ill increase simultaneously. The achievements of medical science and public health in maintaining long life expectancies during many chronic diseases must be considered. In this case, the state of the health of individual contingents of the population changes in a definite manner as a result of limited ability to work (losses in days of ability to work, number of invalids, etc., increase).

The aging process of the population noted in the past 20 years in our country, expressed, as has come to be accepted, as an increase in the proportion of aged individuals (over 60 years), is also having an effect in terms of aging of the economically-active population.

Integrated studies which touch upon demographic and medical aspects and which consider the qualitative characteristics of the population are now very important.

At the October CC CPSU Plenum (1976), Comrade L. I. Brezhnev indicated that the operation of demographic factors associated with the indirect consequences of war would lead to a sharp drop in the flow of work-capable population in the 1980s. In this connection, demographers and medical personnel must find resources for increasing the working ability of those contingents which reach working age during that period. The only way to solve this problem is to carry out a combination of social-economic and medical measures to improve the working ability of the economically active population or, in other words, to reduce losses of working days due to illness and invalidism, and, also, to prevent irreplaceable losses as the result of increased mortality among individuals of working age.

An important factor which affects the normal functioning of labor resources is the state of the health of the population in various age and sex groups participating in social labor. Thanks to scientific-technical progress, the working population is being redistributed in favor of non-production sectors of the economy, and the number of individuals occupied mainly with mental labor is increasing rapidly.

It may seem at first glance that health maintenance is not involved in solving the birthrate problem; however, this is not the case. Health maintenance is able to help individuals or married couples to avoid undesired pregnancy, to bring healthy children into the world, to regulate the intervals between pregnancies, to control the choice of childbirth time as a function of the parent's age, and to determine the desirable number of children in a family.

A conscious attitude to the birth of children within a family and purposeful measures to protect the health of mother and child have a favorable influence on the state of the health of the entire population and, in the final analysis, promote an improvement in the demographic situation.

Intervening in the reproductive cycle and influencing the working conditions of pregnant women, as well as taking care of illnesses of mother and child--these and many other measures of a social-medical nature undoubtedly promote a reduction in child morbidity and mortality in the neo- and post- natal period.

Since health is formed within the family, the results of health maintenance activities directed toward improving the health of mother and child must have a positive influence on the indicators characterizing the state of health of the population as a whole. Demographic policy must be aimed not only toward resolving problems of the quantitative growth in the population, but, more importantly, toward ensuring a high level of health for all of the age-sex contingents making up the population. Regardless of the great importance of social measures to protect the health of the population, it would be a mistake to fail to consider that the family and microsocial environment have an important role in the formation of individual and social health. We are talking here about the health of not only of the children but, also, of the married couples and all family members.

Further improvement of the quantitative health characteristics of the population requires study of demographic patterns and purposeful intervention to change them in a positive way.

Health maintenance institutions must make wide, knowledgeable use of demographic indicators, and influence their improvement in an active manner. Activity to increase the birthrate in most territories of the Russian Federation must now be added to the main goals of health maintenance--maintaining and improving the health of the population. Medical workers must conduct propaganda and education following the territorial-uchastok principle using the resources of the uchastok medical service; they must increase the effectiveness of measures taken to protect the health of women working in areas of production which have a harmful influence on reproductive functioning, and they must intensify prevention of abortions and primary and secondary sterility.

Based on the features and specifics of the demographic situation on the local level, it is necessary to select physicians by individual specialties and to profile the available beds in accordance with the predominance of various forms of pathology. The effectiveness of medical measures to reduce morbidity with temporary and long-term loss of working ability and the control of injuries and related mortality must be analyzed economically.

One of the means of influencing the character of demographic processes and health indicators of the population must be an appropriate demographic policy in the area of health maintenance as a part of the overall demographic policy, the importance and value of which are noted in documents from the 25th CPSU Congress. An important condition for conduct of an effective demographic policy may become medical demography as a section of social hygiene and the organization of health maintenance. Primary attention must be devoted to the development of this discipline.

COPYRIGHT: "Sovetskaya meditsina", 1981

6900
CSO: 1840/303

UDC 614.1: 312.2-053.2](103)

PRESENT TRENDS IN INFANT MORTALITY IN EUROPEAN SOCIALIST COUNTRIES

Moscow ZDRAVOOKHRANENIYE ROSSIYSKOY FEDERATSII in Russian No 1, Jan 81
(manuscript received 21 Mar 80) pp 33-36

POGORELOV, Ya. D., All-Union Scientific Research Institute of Social Hygiene and Organization of Public Health imeni N. A. Semashko

[Abstract] An analysis is made of trends since 1950 in infant mortality in the European socialist countries and a comparison made with these trends in capitalist countries. Since 1950 infant mortality rates in the European socialist countries have dropped as follows: in the GDR by a factor of 5.5, in Poland by a factor of 5, in Bulgaria and Czechoslovakia by a factor of more than 4, in Romania by a factor of 3.8, and in Hungary and Yugoslavia by a factor of 3.5. These rates are faster than in capitalist countries, where the lowered birth rate and improved medical care is affecting this index. A comparison of the indexes for infant mortality and deaths occurring during the first month of life shows that the higher the index for infant mortality the higher the level of deaths occurring in the first month of life (72-80 percent). The indexes for exogenous causes of death in infants in the socialist countries vary widely between 5.1 and 28.9 per 1,000 live births, compared with 2.0 to 3.3 per 1,000 in the Scandinavian countries. Further improvement in the infant mortality rates depends not only on better care of neonates but also better care during pregnancy, birth and the postnatal period; women engaged in physical labor should take particular care during pregnancy. More attention should be given to demographic factors in the socialist countries. One fact that can be seen from analysis of the infant mortality rates is that deaths among boys are more common than among girls in both the socialist and the Scandinavian countries. References 12: 5 Polish, 1 Czech, 6 Western.
[373-9642]

TIME AND INFORMATION MODEL OF HUMAN MEMORY ORGANIZATION

Leningrad VESTNIK LENINGRADSKOGO UNIVERSITETA: EKONOMIKA, FILOSOFIYA, PRAVO in Russian No 5, Issue 1, Mar 81 (manuscript received 16 Oct 80) pp 47-56

[Article by V. A. Ganzen and D. A. Igonin]

[Text] The problem of constructing complete descriptions of man's memory depository in both terms of macro- (capacity ["volumetric"]) characteristics and terms of arrangement, organization of information in it is one of the traditional problems. There are dozens of models that describe organization of traces in long-term memory (LM), and none reflects the universal patterns of construction of systems of traces in the memory depository, regardless of their modal and specific properties. Quantitative models of the potential stock of traces in memory have apparently not yet been constructed, although experimentation on the different dimension-related characteristics of memory has been in progress for more than one decade. Studies of these characteristics in the course of memorizing diverse forms of material under diverse exogenous and endogenous conditions were further developed in the second half of the 1950's, in connection with development of conceptions of two-component theory of memory and accumulation of quantitative data on short-term memory (SM). Most of the experimental psychological studies of various capacity characteristics of LM were conducted with the use of relatively short lists of material to be memorized. In "reproduction" experiments, such lists usually consist of several tens to several hundreds of elements, whereas in "recognition" experiments the number ranges from tens and hundreds to many thousands. True, thus far there have been isolated studies dealing with recognition of elements on lists consisting of many thousands [1]. Such a wide range of variation of capacity-related variables made it possible to find some quantitative functions between the time and capacity parameters of memorizing, storing and reproduction processes. In spite of this, as shown by analysis of the literature, not enough data have been accumulated as yet for an inductive route toward developing quantitative models of memory span.

Knowledge about the maximum capabilities of human memory, which are usually limited to reporting the impressive results of observing memory experts or tests under special conditions such as hypnosis, add little to this conclusion. These data have relative value in constructing quantitative models, since they create the impression of virtually unlimited memory potential, limited only by the natural biological interdictions.

It appeared that development of information theory and rapid penetration of the theoretical information approach into psychology and allied sciences offered new opportunities for investigation of the range of capacity characteristics of memory. According to the hypothetical estimates made on the basis of this approach, the capacity of memory [depository of memory] is in the range of $1.5\times10^{6}-10^{21}$ bits. However, these estimates are not suitable for describing the capacity of the depository in the language of psychology, i.e., the language of the images and other test entities contained in memory, elements of the alphabet that is formed, accumulated and used by man in the course of his life and activities. Another approach to estimation of the capacity of this depository emerged as a result of the attempts made to determine man's throughput in solving problems dealing with object recognition. The greatest difficulty here was to determine the length of the image alphabet, from which a choice was made in memory for recognition. This problem was solved by Sziklai [2], who counted the number of words in dictionaries for designation of graphically reproducible objects. The obtained estimate of 1000 units of object images stored in memory elicited very valid questions [3]. This method of estimation cannot be deemed correct either because the stock of words of a "mimetic" nature in a subject is not tantamount to the volume of his stock of images corresponding to them [4].

Thus, studies of capacity parameters of memory, estimation of its maximum capabilities and the theoretical-information approach are not very productive for determining the psychologically meaningful characteristics of the volume [size] of the memory depository.

For this reason, it is imperative to develop new approaches to modeling memory and develop models reflecting the main laws of organization of this depository. We have considered here one of these approaches and, on its basis, we have constructed a dimensional and structural model of the memory depository, which enables us to make quantitative estimates of its size and, at the same time, describe the organization of the system of traces in a certain hypothetical functional space of memory in the language of psychology, In the model, volume (size [capacity]) of the depository refers to the number of storage units in it (discrete traces), while the concept of structure, which characterizes the distribution of traces in the depository, is interpreted as the structure of order. Let us impose some restrictions on the area of subsequent investigation: let us only consider those parts of the depository that are responsible for fixing traces of various forms of symbolic material, for example, meaningless syllables, words, graphic signs of written language, etc. According to E. Tulving [5], the contextual aspects of differentiation of memory are inessential to the model being developed.

Let us use the method of systematization of concepts on the foundation of bases [6]. Since memory can be defined as storage of information in time, we use the following concepts as the supporting basis: "space," "time," "information," "energy." The diade of "information--time" is the prime element in defining memory, but memory also has certain energy-related and spatial characteristics. However, analysis of the latter in order to derive the corresponding descriptions of memory can be made only on the information and time basis.

Isolation of information--time properties of memory as the bases for modeling it leads us to search for experimental data that are indicative, first of all, of the general class of functions that connect the amount of information stored in the depository to the time of its accumulation, retention and retrieval. The capacity parameters are the most important of the information-related characteristics of memory. The information-related nature of these parameters is manifested by the fact that they constitute a gauge of the diversity of material retained in memory.

Let us list some of the functions between capacity [size] and time parameters of mnemic processes that are known in psychology.

1. Studies of learning processes revealed that the results of many experiments that tested the link between information and time related variables in the course of learning can be satisfactorily approximated by an exponentional function [7]: $y = y_{\max}[1-\exp(-kt)]$, where y is the strength of the skill (in particular, volume of learned material), $y_{\max}$ is the top range of force of skill, t is the number of tests (time parameter) and k is the constant expressing the speed of learning.

2. H. Ebbinghaus and, later on, his proponents defined forgetting as a logarithmic function of time: $y = k(c \log t)$, where y is the volume of material retained, k and c are experimental constants.

3. In Hick's law, the latency period of disjunctive reaction $T_r = a + b \log_c y$, where a and b are constants, a characterizes the nonreducible share of reaction time, y is the length of the signal alphabet, from which a choice is made in signal recognition (volume of traces in memory). If we disregard a, this equation could be written as follows: $T_r = b \log_c y$, hence $y = c^{T_r/b}$.

Thus, in all these cases, information and time, which emerge as attributes of mnemic processes are linked by elementary reciprocal functions: exponential and logarithmic.

In which class of functions should one search for the overt form of the function between size and time variables? The above examples point to the class of elementary exponential functions. In view of the specifics of the phenomenon under discussion (memory) and its property of additivity for verbal material, it is logical to make a certain generalization and turn from exponential functions to the sum of exponential functions and to try to find the sought dependence [function] in the class of these mathematical objects. In general form, the sum of exponential functions could be written down as:

$$y(n) = A_n a^n + A_{n-1} a^{n-1} + \dots + A_1 a^1 + A_0 a^0 \tag{1}$$

Having stated for the sake of simplicity that A_0, A_1, ... equal 1, we obtain:

$$y(n) = a^n + a^{n-1} + \dots + a + 1 \tag{2}$$

which can be expressed in the form of an ascending geometric progression, the first term of which is $b_1 = 1$ and $g - a$.

We use this function to construct the information-time model of memory and formulate the hypothesis of layered organization of the depository, which is based on following theses: 1) the layered nature of the memory depository is construed primarily as functional layering detectable from the information-time signs; the memory layers are orderly and can be numbered; 2) the volumes of sets of traces localized in each of the layers are limited and increase with increase in number of the layer; 3) the number of layers n in the depository is limited ($1 \leq n \leq 8$); 4) moreover, it is assumed that the time characteristics of mnemic processes of retention, storage, forgetting and retrieval increase monotonously with increase in n; 5) the depository can be filled with traces that function on the reproductive, "recognition" and alleviating levels of memory [9]. On the reproductive level of memory, the depository layers are filled successively with increase in number n; on the "recognizing" and alleviating levels of memory such a sequence is not mandatory.

Let us consider the following variables: n--number of layers filled in the depository; a--capacity [size] parameter characterizing capacity of short-term memory for a given type of material, or else, perhaps, the capacity of the short-term repetition buffer [10]; $y(n)$--maximum number of traces in the depository (size of depository) provided that layer n is entirely filled; z--value in the range of $n-1<z\leqslant n$ that characterizes the degree of filling of layer n with traces; $y(z)$--existing volume of traces in the depository with a given value of z. Of the many values of argument z, we shall consider only those with which function $y(z)$ is a whole number in the range of $y(n-1)<y(z)\leqslant y(n)$. According to the hypothesis

$$y(n) = a^n + a^{n-1} + \dots + a^2 + a \qquad (3)$$

If we consider the case when layer n may be partially filled, we can write down the generalizing equation:

$$y(z) = a^z + a^{n-1} + \dots + a^2 + a \qquad (4)$$

from which it is easy to obtain equation (3) by stating that $z = n$. Equations (2) and (3), which can be rewritten in the form of a geometric progression, differ in value of first terms b_1. In the last of them, $b_1 = a$. This is consistent with the assumption that the set of traces that do not exceed the size of short-term memory are located in one layer.

For psychologically meaningful interpretation of the equation and its validation, analysis was made of the data contained in the psychological and lexicographic literature, as well as publications dealing with applied linguistics. This enabled us to isolate and systematize certain "constants" of vocabulary, characterized as the capacity of a subject's verbal memory, as well as the vocabulary store of some types of linguistic vocabularies (Table 1).

As a result of approximate averaging of data listed in Table 1, we obtained a series of empirical values for stores of words, which we were able to approximate with an exponential function of the (3) type, with $a = 5$, which conforms with empirical data [11] and $1\leqslant n\leqslant 8$. We found that it was also possible to demonstrate some values for the vocabulary stocks that were not included in Table 1.

A stipulation must be made pertaining to the number of terms in the series in the right half of equation (3). If we were to keep the first two (on the left) terms of this series, discarding all of the others, the error of estimation of volume $y(n)$ would not exceed 4.5% for any n. This value obviously does not exceed the error of averaging data from Table 1. For this reason, one should then also take into consideration the equation:

$$y(n) = a^n + a^{n-1} \qquad (5)$$

which allows us to determine with some level of reliability the minimal theoretical estimates of lexic constants mnemonically determined. Let us calculate volumes $y(n)$ on the basis of equations (3) and (5), and make some comments about them as psychological realities ensuing from the patterns of functionally layered organization of the reservoir of human memory (Table 2). The data listed in Table 2 conform well with the estimates systematized in Table 1.

Table 1. Lexical stocks of individual and linguistic vocabularies (in ranked form, thousands of words)

Vocabularies		Ranks					Authors and compilers
		first	second	third	fourth	fifth	
Individual vocabulary of adult	Active	-	2.2-5	-	-	-	N.R. French, S. W. Carter, W. Koenig (1930); P. N. Denisov (1969); F. Schonell et al. (1956); Kh. Kasares (1958)
	Passive	-	-	11-18	60-150	-	S. L. Rubinshteyn (1946); R. H. Seashore, L. L. Eckerson (1940); R. G. Piotrovskiy (1969)
	Language of writers' works	-	-	17-21*	-	-	S. L. Rubinshteyn (1946); V. V. Vinogradov et al. (1956-1961)
Linguistic vocabularies***	Orthographic	-	-	15	106	-	D. N. Ushakov, S. Ye. Kryuchkov (1977); S. G. Barkhudarova et al. (1977)
	Defining	-	-	-	57-120**	440-500	S. I. Ozhegov (1978); D. N. Ushakov (1947-1948); A. P. Yevgen'yeva (1957-1961); see also "Modern Russian Language Dictionary" (1950-1965); H. A. Murray et al. (1933); Ph. B. Cove (1961) and others
	Translating (including educational and tourist)	-	-	7-34	70-165	-	A. B. Lokhovits (1966); V. A. Lapidus, S. V. Shevtsova (1962); R. K. Daglish (1965); A. A. Leping, N. P. Strakhova (1971); V. K. Myuller (1970); Ye. I. Leping, N. P. Strakhova et al. (1980)
	Frequency, minimum, basis	0.85	3-4	20-30	-	-	Ch. Ogden (1930); S. L. Abezgauz (1969); L. N. Denisov (1978) and others; E. L. Thorndike (1931

*According to different estimates, the vocabulary of Shakespeare's works, which is considered the richest, is estimated at 15,000-24,000 words (see V. Levik, "Are New Translations of Shakespeare Necessary?" in "Masterstvo perevoda" [The Skill of Translation], Moscow, 1968, p 116).

**Large academic dictionary of Russian literary language, a new edition of which is being prepared by the Institute of the Russian Language, USSR Academy of Sciences, will consist of up to 150,000 words (see "Modern Russian Language," Part 1, edited by P. P. Shuba, Minsk, 1979, p 270).

***Please see next page.

Footnote for Table 1:

***The table includes only the classes of vocabularies [dictionaries], the lexical stores of which could indirectly reflect the minimal, "average" and maximum capacities of human verbal memory from the standpoint of the demands made of it by various aspects of linguistic pragmatics. Moreover, we cannot fail to recognize that the real scale of lexicon usage in oral and written speech, which is considered by the authors of the dictionaries, is determined by the capacity limitations inherent in the memory of language carriers, whose verbal production is taken into consideration in demonstrating the body of the dictionaries' lexicon.

What causes the observed differences in level of function of traces situated in different layers? According to the hypothesis we have advanced, functional layering and structuring of the memory depository are based on its information- and time properties. Let us consider a few hypothetical characteristics that could determine the process of such layering. Let us mention the mean time of fixing of the storage unit as one of these characteristics that is specific to a layer, such time possibly being different for each of the three levels of memory. Another characteristic is the trace storage time in a layer without reinforcement, i.e., repeated actualization. According to the previously formulated hypothesis, time increases proportionately to the layer number in both cases. Bearing this in mind, let us make the following statements.

1. Traces are fixed in the first layers of memory with the least expenditure of time, but they become "extinct" faster. Traces, repeated actualization of which occurs after an interval that exceeds the storage time inherent to a layer, are shifted successively to higher numbered layers and are used in them at lower levels of memory. Only the most frequently actualized traces can be constantly retained in the layers with low numbers. This means that there is organization of traces in layers, according to frequency of their use, in the lexical depository of memory. The conception of such an hierarchy conforms well with many data [12].

2. The first three layers are operative and mainly reproductive; information in them is rapidly fixed and lost. The 4th-8th layers, in which both information storage and fixing time increases (particularly for the reproductive level of memory), service long-term memory proper. Evidently, the resources of the body can provide for the reproductive function of only the first 5-5.5 layers of the verbal memory bank [depository].

The extenisve development of capacity and structure models implies expansion of the categories of cases for which they remain plausible. Such a model can be constructed for the memory bank that records traces of incoherent verbal material. The uniqueness of this material lies in the fact that its units are semantically "loaded"; however, there is no meaningful relation between them. For this reason, the degree of semantic "loading" of units and existence of meaningful relations between them will be discussed as a pair of coordinates for classification of types of verbal material. Let us assume that each type of material can assume one of two fixed values, 0 and 1, on each coordinate. Such a method of systematizing material enables us to single out four types thereof: a) 0.1--meaningless verbal sequences constructed with consideration of grammar and syntax of real language; b) 0.0--meaningless syllables; c) 1.0--incoherent words; d) 1.1--coherent texts.

Table 2. Theoretical estimates of verbal memory store as a function of n ($a = 5$), in words

n	$y(n)$	Psychological interpretation of store
1	5	Short-term memory span
2	30	No data available
3	150–155	Approximate size of chronologically stable vocabulary of general human concepts demonstrated by M. Svodesh and the proponents of glottochronology.* Perhaps, the threshold length of vocabulary of the most commonly used words to assure minimal comprehension of oral speech and covering over 72% of word usage, is contained in it.**
4	750–780	Threshold vocabulary of the most commonly used words that permits comprehension of written language and covers over 70% of word usage in written texts. It provides for satisfactory comprehension of oral speech, since it covers 88-96% of word usage.*** The vocabulary of Ch. Ogden and I. Richards is close to the size of the basic one (850 words).
5	3750–3905	Store of man's active vocabulary. This vocabulary of the most frequently used words covers 88 to 97.5% of word usage, according to different data, in written texts and permits satisfactory comprehension thereof.
6	18,750–19,530	Store of active-passive human vocabulary. It is characterized by lexical wealth of language of outstanding poets and prose writers.
7	93,750–97,655	Potential maximum passive vocabulary of highly educated people
8	468,750–488,280	National lexicon. Perhaps, estimation of the maximum memory store of various verbal traces, at least 80% of which consisting of traces of the alleviating memory level.

---

*Klimov, G. A., "On Lexicostatistical Theory of M. Svodesh," in "Voprosy teorii sovremennoy zarubezhnoy lingvistiki" [Problems of Modern Foreign Linguistics], Moscow, 1961, pp 239-253.

**Mackie, V., "Selection," in "Problems of Selection of Educational Material," Moscow, 1971, pp 35-36.

***Alekseyev, P. M., "Frequency Dictionaries of the English Language and Practical Applications Thereof," in "Statistika rechi i avtomaticheskiy analiz teksta" [Statistics of Speech and Automatic Analysis of Texts], Leningrad, 1971, p 166.

Now let us try to test the model to describe the information and time properties of depositories of meaningless and incoherent words. One of the postulates of the hypothesis of layered organization of memory is the thesis of time-related hierarchy of layers in a depository, according to which words are organized along the time axis with different scales. The time required on the average for fixing storage units in a layer progresses on one of these scales. According to the postulate, it is expected that this time increases proportionately to the layer number. The experimental data available to us create the possibility, in theory, to test this corollary of the hypothesis with respect to the reproductive layer of memory. Such a test would require adapting the model to the experimental reality, for explanation of which it is used. Let us introduce several designations and voice the following assumptions on the basis of the expounded hypothesis: 1) regardless of the store of memory traces $y(z)$, let them always be so arranged as to occupy no more than n layers of sufficient size and fill entirely n-1 preceding the layer and partially or entirely layer n; 2) let average time t_n be required to record a trace in layer n, t_{n-1} be required for layer n-1, etc.; 3) according to this corollary, $t_n > t_{n-1} > \ldots > t_2 > t_1$.

Using these assumptions and equation (4), we obtain the equation for average learning time per unit material T(z) as a function of volume $y(z)$. Apparently,

$$T(z) = \frac{a^2 t_n + a^{n-1} t_{n-1} + \ldots + a_2^2 t_2 + a^1 t_1}{a^2 + a^{n-1} + \ldots + a^2 + a^1} \quad (6)$$

Let us examine the qualitative nature of dynamics of T(z) as a function of volume of learned material $y(z)$. According to equation (6) and by virtue of assumption 3, as layer n is filled with traces we observe a drastic increase in function T(z), followed by either more even increase or some decline with growth of $y(z)$. The latter is possible if filling of a layer starts with fixing of units that require the maximum (within the limits of this layer) expenditure of time for "inscription." The next units, by virtue of the property of invariant mean values, will be remembered in less time, which will cause a decline of the function. Thus, function T(z) increases in jumps, steps and macromonotonously. Jumps of this function should be observed with increase in $y(n)$, starting at points $y(z) = y(n\text{-}1)+1$, while the degree thereof will depend on the magnitude of differences between each t_n and t_{n-1} pair.

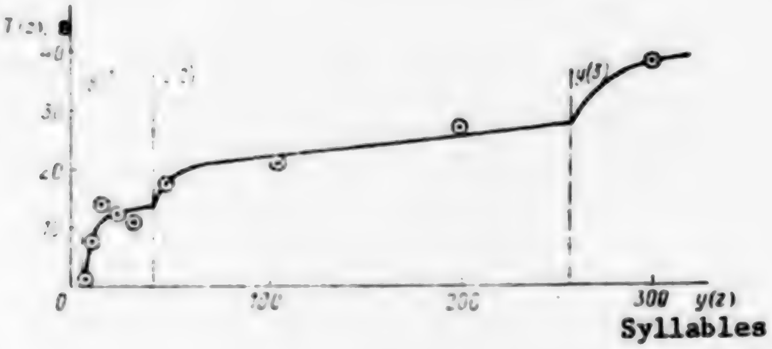

Figure 1. Mean learning time for one syllable T(z) as a function of volume of material to be learned $y(z)$. ⊙--experimental data; solid line--hypothetical function predicted by model. Vertical dash lines were traced through points corresponding to critical values $y(z) = y(n)$

To check the conformity of model predictions with experimental data let us use the results of the classical study of Lyon [13] who obtained, in particular, data on learning time for lists of meaningless syllables differing in length. Let us illustrate these data with the curve of mean time for memorizing one element of the list as a function of the volume of material to be learned (see Figure 1). The expected dynamics of the function are observed with $a = 6$. On the whole, analogous results were also obtained on the basis of the results of studies of the process of learning coherent texts [14]. The plot of T(z) as a function of $y(z)$ is illustrated in Figure 2. The volume of short-term memory for coherent texts was determined with the following considerations. According to existing data, 1.75 simple sentence or 10.5 organized words can be retained in short-term memory [15], which is the maximum estimate of short-term memory span. On the other hand, the probability links between elements of a verbal sequence extend to a depth of no more than 6 words of text [16], i.e., to the depth of a simple sentence. This is the figure we took to estimate short-term memory span for cohesive texts in our analysis of experimental data.

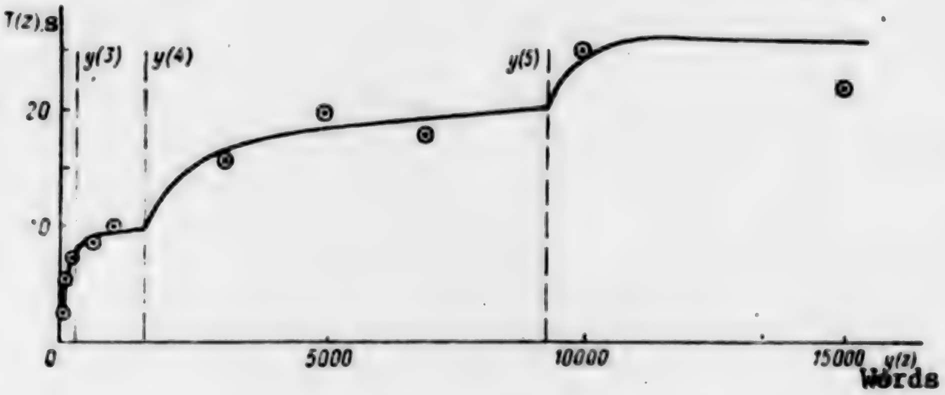

Figure 2. Mean learning time for one word (T(z) as a function of volume of cohesive text to be learned $y(z)$. Designations are the same as in Figure 1.

Thus, the check we undertook enabled us to conform the corollaries ensuing from the hypothesis and expand the class of verbal storages to describe the properties of which it can be used.

The answer to the question of degree of universality of the volume and structural model and hypothesis used as its foundation is of great theoretical interest. Does this model describe organization of verbal material storage or are we dealing with a more general pattern manifested by the arrangement of storages of other forms of human experience? Let us analyze the quantitative aspects of the store of hieroglyphics and structure of the Chinese written language. Numerous reforms of this type of written language were a reaction, not only to the pragmatic requirements of upgradings its graphics, but the significant difficulties involved in learning thousands of hieroglyphic symbols. For this reason, there are grounds to believe that one of the trends in evolution of hieroglyphic written language was the increasing approximation (in the quantitative respect) of its structural distinctions to the natural laws of organization of human memory. Let us assume that 6 graphic objects can be retained in perceptual short-term memory [17]. Let us use equation (3) to calculate the possible volumes of traces in memory that reflect graphic objects, and let us compare them to the quantitative characteristics of the hieroglyphic store of Chinese written language [18] (see Table 3). The data submitted in Table 3 serve as rather convincing evidence of the fact that the volume-structural model describes plausibly the organization of storages of complex graphic forms also.

Thus, on the basis of the hypothesis of functional layering of memory stores a volume and structure model is offered that relates the volume (diversity) of storage to the layer number and span of short-term memory. Maximum estimates were made of volumes of storage layers. It was demonstrated that the model is

Table 3. Theoretical and empirical estimates of man's hieroglyphic store (hieroglyphic symbols)

n	$y(n)$	Empirical estimates	Estimation of store
1	6	6-7	Number of main graphic elements in Chinese written language
2	42	40	Maximum number of main graphic elements and variants thereof
3	258	254	Number of main units of written language (214 keys and 40 graphic elements)
4	1554	1100-2000	Mean number of hieroglyphs contained in minimums adopted in different countries. Apparently, the active hieroglyphic store of man
5	9330	8000-10,000	Maximum [limit] active-passive hieroglyphic store sufficient for comprehension of most written texts
6	55,986	over 50,000	Total hieroglyphic stock of Chinese written language

suitable for predicting effects that were not considered before, on the basis of experimental data. The model has been tested on different forms of verbal material, but data are also submitted indicative of its wider universality. Future confirmation of the phenomenon of functional layering of memory will lead to a substantial revision of the instrumentarium for studies of mnemic processes.

BIBLIOGRAPHY

1. Standing, L. G., Conesio, J. and Haber, R. N., "Perception and Memory for Pictures: Single-Trial Learning of 2560 Visual Stimuli," PSYCHONOMIC SCIENCES, Vol 19, 1970, pp 73-74.

2. Sziklai, G. C., "Some Studies in the Speed of Visual Perception," TRANS. IRE, IT-2, 1957.

3. Lomov, B. F., "Man and Technology," Moscow, 1966, p 197.

4. Glezer, V. D. (editor), "Visual Recognition and Neurophysiological Mechanisms Thereof," Leningrad, 1975, p 73.

5. Tulving, E., "Episodic and Semantic Memory," in "Organization of Memory," edited by E. Tulving and W. Donaldson, New York, 1972.

6. Ganzen, V. A., "Systemic Descriptions in Psychology," VESTN. LENINGR. UN-TA, No 5, 1977, pp 86-91.

7. Hilgard, E. R., "Methods and Procedures for Analysis of the Learning Process," in "Experimental Psychology," edited by S. S. Stevens, Moscow, Vol 2, 1963, pp 11-65.

8. Hick, W. E., "On the Rate of Gain of Information," QUART. J. EXP. PSYCHOL., Vol 4, No 1, 1952.

9. Florens, Ts., "Memory," in "Experimental Psychology," Moscow, No 4, 1973, pp 210-211.

10. Atkinson, R.,"Human Memory and the Learning Process," Moscow, 1980, p 88.

11. Miller, G. A., "The Magic Number Seven, Plus or Minus Two," in "Engineering Psychology," Moscow, 1964, pp 192-225.

12. Frumkina, R. M., "Model of Subjective Forecasting," in "Prognoz v rechevoy deyatel'nosti" [Forecasting in Verbal Activity], Moscow, 1974, pp 18-19.

13. Lyon, D., "The Relation of Length of Material to Time Taken for Learning and the Optimum Distribution of Time," J. EDUC. PSYCHOL., No 5, 1914, pp 85-91.

14. McGeoch, J. and Irion, A., "The Psychology of Human Learning," New York, 1952, p 489.

15. Leont'yev, A. A., "Psycholinguistic Units and Generation of Verbal Uttering," Moscow, 1969, p 307.

16. Alekseyev, P. M., German-Prozorova, L. P., Piotrovskiy, R. G. and Shepetova, O. P., "Bases of Statistical Optimization of Foreigh Language Instruction," in "Statistika rechi i avtomaticheskiy analiz teksta" [Statistics of Speech and Automatic Analysis of Texts], Leningrad, 1974, p 206.

17. Miller, G. A., Op. cit.

18. Sher, A. Ya., "What Needs to be Known About the Chinese Written Language," Moscow, 1968.

COPYRIGHT: Vestnik Leningradskogo universiteta, 1981

10,657
CSO: 1840/313

UDC 629.78:[612,881+612.8582

OTOLITHIC REFLEX AND SPACE PERCEPTION FUNCTION OF COSMONAUTS

Moscow VESTNIK OTORINOLARINGOLOGII in Russian No 4, Jul-Aug 81 (manuscript received 20 Jan 81) pp 3-6

[Article by I. Ya. Yakovleva and L. N. Kornilova]

[Text] Space flights have shown that many cosmonauts develop disorders in space perception and symptoms of motion sickness. Many judgments and hypotheses have been advanced about the genesis of the symptom complex of motion sickness and illusions of spatial position in a space flight. However, the majority of researchers attribute the greatest importance to the unusual functioning of the otolithic apparatus and the systems interacting with it (V. V. Baranovskiy et al., 1962; Ye. M. Yuganov, 1963; I. I. Bryanov et al., 1973; Solodovnik, F. A., 1977; Graybiel, 1966; Reason, 1969; Steele, 1970; and others). Studies of the human vestibular function under conditions of weightlessness (M. D. Yemel'yanov and Ye. M. Yuganov, 1962; B. B. Yegorov and G. I. Samarin, 1970; I. I. Bryanov et al., 1973; Graybiel, 1967; Berry, 1973) have revealed individual reactions indicating the possible change in functioning of the vestibular apparatus.

The task of this work was to study the phenomenology of the reactions of the vestibular system and the space perception function from data of pre- and post-flight examination. Examination was made of 24 cosmonauts who had made flights on craft of the type Soyuz and Soyuz-Salyut in 10 short-term (4-19 days) and 5 long (30-175 days) flights.

All the cosmonauts passed expert clinical-physiological examination and were pronounced healthy, including the condition of the otorhinolaryngological organs.

This work used a special questionnaire on reactions during a space flight. It studied the otolithic reflex according to intensity of the reaction of eyeball counterrotation using a visual successive image representation in a transition from vertical to horizontal position to the right and left side. This is a modification of the method of indirect otolithometry of Fischer (1930) and Fluur (1975) (L. N. Kornilova et al., 1979). A study was also made of the function of spatial coordinate perception using a portable "Vertikal'" instrument (B. B. Bokhov et al., 1973) in the sitting position and in a horizontal position on the right side.

The otolithic reflex and the spatial coordinate perception function were studied from 3 to 6 times 30-45 days before the flight and a similar number of times on the 0 and first-second, fourth-fifth day after the flight. In lengthy expeditions, the study was also made on the eighth-ninth day, and from indications in

1 month after the flight. All methods were used to preliminarily determine the standard reactions in examining 112 healthy male individuals in age from 25 to 40.

During the preflight period, the indicators for the intensity of the otolithic reflex in all the cosmonauts, with the exception of three, was either in the limits of normal physiological fluctuations, symmetrical, or the asymmetry did not exceed the physiological spread. The commanders of the crews from the craft Soyuz-22 and Soyuz-31 had low indicators of this reflex (1-2°). The commander of the crew from the craft Soyuz-26 and the flight engineer of the craft Soyuz-22 had asymmetry of the reflex (S>D) exceeding the physiological spread. It was 8° and 9°.

Indicators for the accuracy of spatial coordinate perception accuracy in all the cosmonauts, with the exception of three, were in limits of normal physiological fluctuations. Asymmetry because of a significant exceeding of error in the left-side position to 32-38° was noted in three cosmonauts (flight engineer of the craft Soyuz-22 and Soyuz-T-2, flight engineer of the first expedition of the Soyuz-Salyut-6 orbital complex, and the commander of the crew from the craft Soyuz-28).

Results of questioning the cosmonauts after the flight indicated that in weightlessness, the illusory reactions were observed in 90% of the subjects, and autonomic discomfort of varying degree of pronouncement in 50%. The illusory reactions were mainly of the upside down type, sometimes in the form of shifting of surrounding objects. The time for appearance and duration of these reactions was very individual. In the majority of cases, the illusions developed immediately upon entering weightlessness, while autonomic discomfort developed after an hour, or in different periods to 1½ days. The illusion lasted several minutes in some, in others up to 4 h and more. It further emerged occasionally, most often at the mement of intensified movement activity, or under the influence of optokinetic stimuli. The autonomic reactions lasted from several hours to 3-7 days. They intensified during motor activity, or under the influence of optokinetic stimulation. Some cosmonauts noted a link between the development of vestibuloautonomic disorders and the appearance of sensations of blood rushing to the head. Symptoms of motion sickness in flight diminished with limited motor activity after sleep and rest. During repeated participation in flights, the symptoms of motion sickness always were less pronounced.

One can isolate three types of the body's adaptation to the effect of the set of space flight factors: resistent type--either the absence of autonomic and sensory discomfort, or the presence of weakly pronounced illusory reactions (9 people); violent but comparatively short (up to 2-3 days) period of adaptation (8 people); torpid type of adaptation--not very pronounced, but lengthy symptoms of vestibuloautonomic discomfort and sensory disorders (7 people).

After the flight, sensory reactions and vestibuloautonomic disorders of varying intensity were noted in 6 out of 24 subjects in the 0-first day, and in all of them, statokinetic disorders in the form of swaying during walking, and instability in Romberg's position.

Changes in the functioning of the otolithic organ were observed on the first-second day both after lengthy flights (in all the cosmonauts we examined), and after short flights (in 14 of the 18 subjects). The majority of observations (16) revealed hyperreflexia (two- and one-sided) of the otolithic reflex (21-38° with a normal of 12±7°). In 2 cosmonauts (after 175-day and 7-day flights), one-sided hyporeflexia was recorded, a decrease in the reflex from 12 to 5° and from 15 to 6°.

The second feature of change in the otolithic reflex was the appearance of asymmetry reaching 8-14° (normally to 3°). Asymmetry of the reflexes was more pronounced (to 14°) and was observed in all the cosmonauts who made long flights, and in 4 of the 18 cosmonauts after short flights. A change was observed in 5 of the examined cosmonauts in the directivity of asymmetry after flight. The tendency towards normalization of the revealed shifts after short flights was generally noted on the second-fourth day, after long flights on the eighth-ninth day, and in 2 cosmonauts, in a month after completion of the expedition.

We should make a special examination of the data from studies made in the first hours after landing in eight cosmonauts after short expeditions. No changes were found in four of them, while a paradoxical reaction to inclination of the head in a frontal plane was noted in four (negative otolithic reflex--rotation of the eyeballs towards the inclination). This reaction was recorded in 3-5-fold studies. Repeated examination of these cosmonauts on the second day after the flight did not reveal the paradoxical reaction of the otolithic apparatus in three of them. A tendency towards normalization (positive reflex) was noted, however, the recorded indicators did not always reach the background level. The negative otolithic reflex was maintained in one cosmonaut even on the second day after the flight.

The accuracy of spatial coordinate perception after lengthy expeditions was disrupted in all the cosmonauts. The changes were characterized either by an increase in the error in the lateral positions (to 38° with a normal of 18±5°), or by asymmetry of the indicators to 14° (with a normal to 5°). A tendency towards restoration was observed on the 8th-10th day, and in 2 cosmonauts, on the 32nd day after the flight. After short flights, analogous shifts were noted in 10 out of 20 subjects. The error in lateral positions sometimes was 38°, and 3° in the sitting position. A tendency to restoration was noted on the second-fourth day.

Thus, as in the previous studies (L. N. Kornilova et al., 1977, 1979), it was shown that the effect of the space flight factors induces temporary changes in the space perception function and the otolithic apparatus of a healthy person. More significant and lengthy shifts were observed in long expeditions. To a certain degree one can speak of the changes of single-type directivity (increase in the reactivity of the otolithic organ, deterioration in the accurate perception of spatial coordinates, asymmetry of the studied indicators), and individual reactions (degree of changes, dynamics of readaptation, development of vestibulo-autonomic discomfort in weightlessness).

The increase in reactivity of the otolithic organ detected in the majority of cosmonauts after flights can be viewed as a result of the reaction to a strong stimulus in the form of terrestrial gravity after a period of so-called deafferentation under conditions of weightlessness. At the same time, for certain individuals after the return to earth, this adequate stimulus, gravity, was so strong that it did not induce intensification of the reflex, but its suppression (inhibition beyond the limit), or even distortion in the form of a paradoxical reflex.

It is impossible to exclude that the paradoxical reflex observed on the zero days was apparently dictated by the phase changes in the neuronal structures responsible for this reflex. Similar distortion of the tone reflexes of the eye muscles was noted previously by Sentagotai (1967) in lengthy stimulation of the receptor. The studies of N. S. Alekseyeva et al. (1980) made in the clinic of Professor V. T . Pal'chun noted a paradoxical otolithic reflex in the form of the eyeball turning towards the inclination of head and torso in 9 out of 100 examined patients. This reaction was observed in patients in the period preceding a vestibular crisis or after its completion.

Reduction in the pronounced nature of the negative reflex and its transition to positive were recorded by clinical physicians during favorable dynamics of the process as a consequence of treatment. At the same time, the results of the examination of cosmonauts do not permit a complete analogy with the clinical findings since the paradoxical reflex was observed by us in the absence of any manifestations of vestibular dysfunction.

The shifts observed fairly often in perception of spatial coordinates can probably be explained by complex disorders in the coordinated activity of sensory systems, and by the change in afferent impulses from the otolithic apparatus and other gravity receptors initially as a result of the effect of weightlessness, and then the earth's gravity.

The nature of changes in the activity of the vestibular apparatus after a flight provides the grounds to hypothesize the interest not only of the peripheral, but also the central vestibular formations, as well as the integrative mechansims of coordinating the activity of the afferent systems. It is impossible to exclude the importance of the change in regulatory mechanisms for the neurohumoral factors and the hemoliquorodynamic shifts in the development of the general adaptive reaction of the body (including the vestibular apparatus) to the effect of flight factors and post-flight readaptation to the conditions of the earth's gravity.

In order to pinpoint the mechanisms for motion sickness in weightlessness, it is also necessary to make neurophysiological studies (first of all on animals) under space flight conditions.

BIBLIOGRAPHY

1. Alekseyeva, N. S., Petrova, Ye. I., Yakovleva, I. Ya. et al. VESTN. OTORINOLAR. No 5, 1980, pp 41-45.

2. Baranovskiy, V. V., Yemel'yanov, M. D. and Kuznetsov, A. G. ZH. VYSSH. NERVN. DEYAT., No 6, 1962, pp 1001-1070.

3. Bokhov, B. B., Kornilova, L. N., Yakovleva, I. Ya. et al. KOSMICHESKAYA BIOL., No 6, 1973, pp 51-56.

4. Bryanov, I. I., Matsnev, E. I. and Yakovleva, I. Ya. IBID, No 3, pp 85-88.

5. Yegorov, B. B. and Samarin, G. I. IBID, No 2, 1970, pp 85-86.

6. Kornilova, L. N., Syrykh, G. D., Tarasov, I. K. et al. KOSMICHESKAYA BIOL., No 5, 1977, pp 90-91.

7. Kornilova, L. N., Syrykh, G. D., Tarasov, I. K. et al. VESTN. OTORINOLAR., No 6, 1979, pp 21-24.

8. Solodovnik, F. A. KOSMICHESKAYA BIOL., No 3, 1977, pp 85-86.

9. Yuganov, Ye. M. "Aviatsionnaya i kosmicheskaya meditsina" [Aviation and Space Medicine], Moscow, 1963, pp 496-500.

10. Sentagotai, Ya. and Solodovnik, F. A. "Rol' otdel'nykh labirintnykh retseptorov pri ustanovke, oriyentatsii glaz v prostranstve" [Role of Individual Labyrinthine Receptors in Adjustment and Orientation of Eyes in Space], Leningrad, 1967.

11. Berry, C. "Biotechnology. Bioastronautics Data Book," Washington, 1973, pp 349-415.

12. Graybiel, A. "Orientation in Aerospace Flight" (Special report 66-6 NASA, P-93), Pensacola, 1966.

13. Fischer, M. ARCH. OPHTHAL, Vol 123, 1930, pp 509-531.

14. Fluur, E. ACTA OTO-LARYNG. (Stockh.), Vol 79, 1975, pp 111-114.

15. Reason, J. NEW SCI., Vol 2, 1969, pp 28-31.

16. Steele, Y. "Symposium on the Role of the Vestibular Organs in Space Exploration," Fourth, Washington, 1970, pp 88-96.

17. Yakovleva, J. Y., Bohov, B. B. and Kornilova, G. N. "Study of Space Perception Functioning during Simulation of Certain Space Flight Factors," "COSPAR Life Sciences and Space Research XIV," Akademic-Verlang, Berlin, 1976, pp 295-300.

18. Yakovleva, J. Y., Kornilova, G. N., Syrykh, A. D. and Tarasov, J. K. "Studies of Vestibular and Spatial Perception Functions: The Soyuz-19-ASTP, Soyuz 21-Salyut-5 and Soyuz 22 Missions," "Abstracts of Papers of the 28th International Astronautical Congress. Prague, Czechoslovakia, September 25-October 1, 1977."

COPYRIGHT: "Vestnik otorinolaringologii", 1981

9035
CSO: 1840/308

UDC 615.471: 615.849.12.015.3

DOSIMETRIC GUIDE-RULE FOR CALCULATING ABSORBED DOSES OF ELECTRON RADIATION

Moscow MEDITSINSKAYA RADIOLOGIYA in Russian Vol 26, No 6, Jun 81
(manuscript received 29 Dec 80) pp 56-57

KOZLOV, V. A. and DENISENKO, O. N., Scientific Research Institute of Medical Radiology, USSR Academy of Medical Sciences, Obninsk

[Abstract] The laboriousness of determining the absorbed dose of fast electrons in a tissue-equivalent madium using an ionization dosimeter scaled for gamma-radiation and the unacceptably large margin of error (up to 20 percent) prompted development of a dosimetric guide rule for doing these calculations quickly and accurately. The guide-rule consists of a frame with scales marking the calibration coefficients shown as a function of the size of the ionization chamber, electron energy, temperature and pressure, together with two lined sighting slides (shown in illustrations), one of which moves in the horizontal plane and the other in the vertical plane. An example is shown of a calculation using this guide rule providing a result with an error of 10 percent before final corrections were made. This device is now in use in the clinical dosimetry laboratory at the Scientific Research Institute of Medical Radiology, USSR Academy of Medical Sciences. Figures 2; references 3: 1 Russian, 2 Western.
[374-9642]

UDC 615.849.114.015.3

COMPARISON OF EXPERIMENTAL GAMMA-RADIATION INSTALLATIONS USING SET OF THERMOLUMINESCENT DOSIMETERS

Moscow MEDITSINSKAYA RADIOLOGIYA in Russian Vol 26, No 6, Jun 81
(manuscript received 4 Dec 80) pp 52-55

GUBATOVA, D. Ya., GREBENSHCHIKOV, V. L., KANTOROVICH, L. N., FOMINYKH, V. I., OBORIN, A. V., FROLOVA, A. V. and KARYAKINA, N. F., Riga Medical Institute

[Abstract] A TELDE radiation testing system was used to evaluate and compare the radiation characteristics of experimental gamma-radiation installations at the Moscow Scientific Research Institute of Roentgenology and Radiology, the All-Union Scientific Research Institute of Metrology and the All-Union Scientific Research Institute of Physico-Technical and Radio Technical Measurements. The purpose of the exercise was to test the TELDE system itself, to resolve the question of whether or not these installations can be granted certification, and to verify that this method can be used for evaluating the dosimetric characteristics of gamma-therapy installations. Using the peak readings for thermoluminescence, the TELDE system, incorporating pellets of Ca, Mg, Ti and lithium fluoride measuring 3.5±0.3 mm in diameter and 2.0±0.2 mm thick and packed in 0.1-mm thick polyethylene film three to a packet, was used to generate 1, 3, 10, 30, 100, 300 and 1,000 rads. Results showed that the differences between the three installations tested were less than 6 percent. The TELDE system is recommended for use at doses greater than 10 rad for certification of radiation installations. References 6: 2 Russian, 4 Western.
[374-9642]

UDC 331.015.11: 612-0 681.3

MEASURING/COMPUTING COMPLEX FOR AUTOMATION OF ERGONOMIC EXPERIMENTS

Moscow TEKHNICHESKAYA ESTETIKA in Russian No 1, Jan 81 (manuscript received 19 May 80) pp 27-29

[Article by O.V. Afanas'yev, engineer, R.P. Burnusuzov, engineer, B.V. Yelatomtsev, engineer-mathematician, A.V. Korinevskiy, candidate of biological sciences, and A.A. Kosolapov, engineer-mathematician, All-Union Scientific Research Institute of Technical Aesthetics]

[Text] In recent years, a quite extensive study has been made in ergonomics research of the operational-technical aspect of processes involved in the activity of the human operator under various conditions. However, the characteristics established in this study for the functional components are most often qualitative and inadequate for determining conditions for the most efficient organization of a given type of activity. The problems of practical ergonomics require quantitative evaluations of human possibilities in receiving and processing of information, and also in executing control and executive actions.

The essential quantitative indicators can be obtained with the aid of given mathematical methods when studying psychophysiological mechanisms and physiological systems and by using means with which other forms of activity are realized. One used form of processing experimental results (or results from observations or questionnaires) in increasing use is the use of the computer, which makes it possible to handle enormous amounts of figures at speeds that exceed human capabilities by several orders of magnitude.

The most efficient method when using a computer is to set up automated experiments during the course of which the presentations can be altered depending on results from the processing of behavioral or phsyiological indexes in the subjects. This provides an opportunity not only for online analysis of a multitude of characteristics during the course of literally a single study, but also for setting up experiments that are basically impossible on the basis of any other kind of technical equipment--experiments during the course of which "decisionmaking" is possible in time intervals measured in milliseconds.

In order to automate ergonomic research it is necessary to set up a measuring-and-computing system that provides simple access for the user (the psychologist or physiologist), rapid changes in the type of study, online formation of the experimental situation, immediate analysis of the subject's responses and so forth. All this can be achieved only by using the appropriate technical and mathematical base.

Ergonomic research should include, in particular, a study of processes such as detection, identification, recognition, data search, decisionmaking, tracking, the development of motor skills and so forth. Automation of the study of these processes is impossible without hooking up with the computer test benches equipped with various kinds of control organs (for example, multistage manipulators) and a system for presenting various kinds of information. Unfortunately, standard apparatus of this kind does not exist. For example, visual presentation of data is used only by instruments such as the FS-02 photostimulator [fotostimulyator], slide projectors and luminescent indicators. Each of these instruments has defects that make it impossible to set up a satisfactory system based on all these devices for presenting information in an ergonomic experiment: even though the FS-02 and luminescent indicators have good temporal parameters, when they are used it is possible to present only nonstructured signals or an extremely limited set of symbols; even though the information that can be presented with the slide projector is very varied, its temporal parameters are totally unsatisfactory. Meanwhile, for ergonomic studies, what is required is also a facility for altering brightness, size and other image characteristics across an extensive range of light. Standard stimulation apparatus produced for presenting information in any other mode (audio, tactile and so forth) also has design defects.

The main variables in ergonomic studies of operator activity are productiveness, accuracy and speed. Consequently, an automated system should be equipped with the appropriate sensors for recording these parameters, such as can be either selected from the existing range of products or developed (by proceeding from the requirements of a given system and the given aims of a study).

The most important characteristics in evaluating the functional status of a subject are the various electrophysiological indexes, namely the electro-oculogram, the electrocardiogram, the electromyogram, the skin-galvanic reaction, the electroencephalogram, evoked potentials and so forth. Multichannel systems for amplifying and recording these characteristics do not yet exist; there are only individual successful developments of instruments for recording just some of them (for example, the EKG and the electromyogram). Broad development of new instruments is most essential here.

Automation of ergonomic studies presents specific requirements not only on the technical configuration of equipment but also on the software. Three problems can be distinguished that occur when setting up an optimum measuring-and-computing complex.

The first is connected with the conducting of the experiment itself, namely the presentation of stimuli in various modalities and of various durations in a given temporal sequence. Formulation of an experimental situation with the aid of a computer depends on the creation of job control programs based on a developed system of numeric input-output lines.

The second problem is associated with collecting and recording a large amount of information of various types (psychometric data, electrophysiological indexes) and presenting it in a form convenient for subsequent processing. For this, it is necessary to create job control programs for analogue input and output and programs for switching data between the computer storage and an additional external storage (magnetic tape storage, magnetic disk storage) in a given format.

Finally, the third problem is connected with data processing, which can be done both in real-time during the experiment, and independently with data recorded on an external carrier.

Success in resolving the first two problems depends largely on the configuration and technical specifications of the measuring-and-computing complex. As for the third problem, by its very nature the data processing can be divided up into primary processing done directly with the data obtained during the experiment, and secondary processing, which is done with the results obtained from primary processing. Primary processing can be done in real-time during the experiment, and here its possibilities are limited by the temporal parameters of the experiment and the storage facilities and operating speed of the computer. The program for primary processing can include computation of experimental statistics, correlation functions, spectral evaluations and so forth. Primary processing data can be used to form an experimental situation; in other cases they can be independent and final results from a study.

Secondary data processing is used primarily to obtain statistical characteristics from series of experiments, groups of subjects, functional states and so forth. This processing can also include various procedures for formal classification in discriminant, factorial and cluster analysis and programmed organization of data in given structures for storage in a form convenient for the user.

One of the basic requirements in an automatic control system for an ergonomic experiment is flexibility that provides a facility for online intervention by the experimenter in the experimental process and for altering various parameters in the experimental situation as needed.

The software system for a measuring-and-computing complex that effectively solves all the problems enumerated can be set up on the basis of an online, real-time system. Here the designer encounters a number of difficulties. The first is that the existing systems of this type are not suitable in practice for using a computer for line experiments; the second difficulty is that existing systems have been developed for operation with slow-speed peripherals, mainly teletype machines; a third difficulty is that they are quite complex and their efficient utilization depends largely on the qualifications of the user. The degree of complexity in the control language for tasks and, correspondingly, the amount of time spent by the system "on itself" frequently lead to losses of machine capability, impermissible in real-time systems, and to the impossibility of setting up a number of "on line" experiments with it. As a result, when using most present-day computers in control systems, it is usually impossible to use their standard software (this applies to the online systems of the YeS and the IBM-360/370 series computers).

In the absence of an appropriate online system, in each individual study it is necessary to write a set of executive programs to solve a number of specific problems. These programs are designed to reduce loss of time thanks to the elimination of universal algorithms for storage allocation, input-output planning and so forth. Requirements for fast operating speeds and compactness lead to the need to write a large number of programs in assembler language despite the fact that there is lack of compatibility between the main equipment and other computers and a large amount of additional time is spent on programming. Thus, when using computers in automated experiments, one of the most important and still unsatisfactorily resolved problems is that of developing software for the real-time system.

Despite the difficulties enumerated in both hardware and software it was decided at the All-Union Scientific Research Institute of Technical Aesthetics to develop a computer-based measuring-and-computing complex. This decision was based on the conviction that at the present stage in the development of research the main application for the computer should be not only faster data collection with traditional methods but also--and this is most important--the development of new methods based on the unique facilities of the computer to do complicated processing on large volumes of data and to react, depending on results, to external events at a rate dictated by them.

The advantages of using a computer in conditions for controlling an experiment can be not only promising but also sometimes the only possible way of solving many tasks correctly and rapidly. In particular, it becomes possible to reduce considerably (compared with noncontrolled experiments) the number of experiments needed to obtain statistically significant results with the firm association of various physiological and psychophysiological functions and behavioral acts.

A measuring-and-computing complex meeting these requirements was developed at the All-Union Scientific Research Institute of Technical Aesthetics during the period 1977-1979. The complex consists of a YeS-1010 computer, a Plurimat-S signal analyzer, equipment for experimental visualization and a soundproof room.

The technical specifications of the main components of the measuring-and-computing complex are as follows:

YeS-1010 computer: storage, 32 Kbits; operating speed 10,000 operations per second; external storage 0.8 Mbits on magnetic disk, 4 magnetic tape stores; 24 numeric input and 56 numeric output lines (16 bits per line), alhpanumeric printer, console keyboard, alphanumeric display, punchtape input and output;

Plurimat-S signal analyzer: 64 Kbits storage, operating speed 10,000 operations per second, external storage 2X5 Mbits (interchangeable disk packs), numeric input and output terminals, 16 bit, 16-channel analog input terminal, console keyboard, Hewlett-Packard X-V-1300 display unit, X-V analog output unit;

experimental camera and test bench: KL 104A LED indicator (8-segment 0.5 X 1 cm. matrix, switching time 25 microseconds), subject console incorporating 16 pushbuttons, tachistoscope, EEG-111 electroencephalograph.

The tachistoscope and the test bench with the LED indicators are designed for presenting visual information. The test bench with the LED indicators is equipped with a device that makes it possible to present visual information selectively to the left or right eye.

The computer and signal analyzer can operate independently, with the experimental camera, or jointly, supplementing each other. A line input-output interface was developed for their combined operation that makes it possible to efficiently insure real-time experimental conditions. Here, the following division of functions was made: the computer fulfilled the function of creating the experimental situation, that is, the control elements for the equipment on the experimental test bench and the acquisition of psychometric data (reaction time and correctness of reaction were recorded using the pushbuttons on the subject console) while the signal analyzer collected electrophysiological data. In addition, with the aid of the interface developed, the computer set the mode for the acquisition, recording and primary processing of electrophysiological indexes by the signal analyzer. This operating mode was set up in two ways. First, using machine language a program was written for the YeS-1010 computer that made it possible to conduct an experiment with presentation and testing of visual information, while the experimenter could rapidly make real-time changes to the parameters set and restructure the temporal characteristics of the experiment. Second, a special program package was written and debugged; this made it possible to set up and debug the experimental program written in FORTRAN for the YeS-1010. This software package contained the following programs:

dumping stored data between storage and the numeric input-output lines;

startup, polling and shutting off the time sensor (accuracy 0.0001 seconds);

instructing the signal analyzer on operating mode using the interface;

dumping data between storage and disk storage (in the existing version of FORTRAN the YeS-1010 had no facility for operating with disk files).

The first method requires heavy expenditure on writing and debugging the program for the experiment while the use of the YeS-1010 storage is economical. While it reduces programming costs, the second method requires a large storage. When the YeS-1010 and the Plurimat-S signal analyzer are operating together in real-time it is possible to partially overcome these defects and make effective use of the strongest aspects of the equipment.

The Plurimat-S signal analyzer has a special operating, real-time system, the PS-600, which is designed for the acquistion, recording and processing of data and signal conditioning, which makes the signal analyzer indispensable when conducting ergonomic studies both during the experiment and in automatic mode. The PS-600 provides a facility for operating with memory units and visualizing data modules on the Hewlett-Packard 1300A X-V display unit, and also for outputting the contents of data modules to the X-V recorder via the analog output terminal. The PS-600 has facilities for debugging and organizing programs on disk files.

In addition to the PS-600, the basic software for the signal analyzer includes FORTRAN IV and assembler languages and it makes up a system for organizing SISFIK files [expansion unknown; this is a linker] which makes it possible to combine the operation of programs written in different languages on the same data files. An experimental program was written on the PS-600 with a facility for presenting visual stimuli, together with a number of programs for processing data in automatic mode.

The following have now been written for the Plurimat-s signal analyzer:

a program for automatic processing of the EEG, making it possible to monitor dynamically the psychophysiological states of the human operator in various work conditions;

a program for processing curves reflecting the fine structure in the executive activity of the operator in different tracking tests with the use of multistage hand manipulators;

a program package for automated secondary data processing, including a program for statistical computing, hypothesis checking and various versions of cluster analysis.

Since the measuring-and-computing complex was started up (February 1979), the following work has been done and is in progress:

studies of the microstructure in instrument spatial executive activity in the human operator in various tracking modes, including analysis of point characteristics in operator movements in three of their phases, namely latent (programmed), physical (realization) and the control and correction stage;

studies on electrophysiological indexes in experiments, including evaluation of operator functional states (spectral-correlation and coherent analysis);

experiments with human operators to study direct and feedback masking signals and recording and analyzing psychophysiological and electrophysiological data online;

a study of human sensory perception of magnetic fields at voltages similar to those in electronic and electrotechnical equipment in general use;

processing data from expert assessments of some of the technical qualities of radiotechnical instruments.

In the near future, using the measuring-and-computing complex it is intended to conduct experiments to study the psychological features in human decisionmaking on the basis of game theory, and also factorial analysis of ergonomic assessments of the qualities of cultural and everyday articles and secondary processing of electrophysiological data, including clustering of evoked potentials.

Further development of the complex, and also the use of its facilities not only for ergonomic experiments but also for a number of other very important pieces of research work at the All-Union Scientific Research Instituute of Technical Aesthetics (including in the field of graphic design) depends directly on increasing the capability of the computer and its main components and adding up-to-date peripheral electrophysiological and recording equipment. Existing software and the software developed for the complex already make it possible to solve a number of problems in the field of graphic design work, expert assessments, factorial analysis, game theory and so forth.

Equipping the measuring-and-computing complex with more powerful computers and other essential equipment would make it possible during the 11th Five-Year Plan to expand significantly the specific range and volume of problems that can be solved with its help, and to enhance the effectiveness of scientific research and graphic design activity at the All-Union Scientific Research Institute of Technical Aesthetics.

BIBLIOGRAPHY

1. Lomov, B.F., Nikolayev, V.I. and Rubakhin, V.F. "Questions of the Use of Mathematics in Psychology" in "Psikhologiya i matematika" [Psychology and Mathematics], Moscow 1976, p 6.

2. Zinchenko, V.P., Munipov, V.M. and Smolyan, B.L. "Ergonomicheskiye osnovy organizatsii truda" [Ergonomic Principles in the Organization of Labor], Moscow, 1974.

3. Korinevskiy, A.V., Kosolapov, A.A., Samaylovich, L.A. and Trush, V.D. "On Ways To Make Practical Use of Computers in Ergonomic Studies" in "Problemy inzhenernoy psikhologii" [Problems of Engineering Psychology], Moscow 1979, p 10 (Transactions of the All-Union Scientific Research Institute of Technical Aesthetics, "Ergonomika" series, 4th edition).

4. Slivnitskiy, Yu.O. "Control of Executive Activity under Conditions of Restricted Visual Feedback" in "Problems of Engineering Psychology" (op. cit.)

5. Kosolapov, A.A., Samaylovich, L.A. and Trush, V.D. "Studies on Adjustment Levels in the Decisionmaking Process" in "Problems of Engineering Psychology" (op. cit.).

COPYRIGHT: Vsesoyuznyy nauchno-issledovatel'skiy institut tekhnicheskoy estetiki, 1981.

9642
CSO: 1840/322

UDC 616.89-092.11

MENTAL PHENOMENA IN A HEALTHY PERSON WHICH RESEMBLE THE PSYCHOPATHOLOGICAL

Moscow ZHURNAL NEVROPATOLOGII I PSIKHIATRII IMENI S. S. KORSAKOVA in Russian
Vol 81, No 6, Jun 81 (manuscript received 16 Jul 79) pp 916-920

KOROLENKO, Ts. P. and GALIN, A. L., Department of Psychiatry and Medical Psychology, Novosibirsk Medical Institute

[Abstract] Aspects of the difficulties encountered in differentiating between normal and pathopsychological behavior are discussed. Although philosophizing is considered an unproductive type of thinking, studies showed that it is frequently observed in the initial stages of logical thought requiring the ability for abstraction; in this sense, philosophizing should not be considered an abnormal mental phenomenon. A style of thought similar to autism is sometimes seen in adolescents indulging in excessive day-dreaming about accomplishment of desired ends as their life-style stereotype is developed; this, too, is not considered abnormal. Ambivalence should not automatically be regarded as a clinical symptom since it can reflect a deeper dialectic though process involving analysis of contradictory ideas. The greatest danger of erroneous interpretation of seemingly abnormal psychic phenomena occurs when assessing the personality that is at a high level of development: all three traits--philosophizing, autism and ambivalence--may be seen as variants of the normal mental structure in such personalities. Care should be taken to consider the role of circumstances in personality development when assessing the status of the mind. References 8: 6 Russian, 1 Polish, 1 Western.
[330-9642]

PSYCHOLOGY

PSYCHOLOGY: RESULTS, PROBLEMS, EXPERIMENTS

Moscow PRIRODA in Russian No 2, Feb 81 pp 2 -31

[Article by Boris Fedorovich Lomov, corresponding member, USSR Academy of Sciences and USSR Academy of Pedagogical Sciences, professor, director of Institute of Psychology, USSR Academy of Sciences]

[Text] At the 25th CPSU Congress it was emphasized that "new possibilities for fruitful research, both general theoretical and basic, and, also, of an applied nature, are opening up at the boundaries between different sciences, particularly the natural and social sciences. These should be utilized to the fullest extent." [1] These words can rightfully be also applied to psychology. Investigating the problems of the development of a person as a whole, psychology, whether it intends to or not, makes use of the discoveries of the most diverse sciences: the social, when it grapples with questions of the development of the individual, processes of communication or the dynamics of collectives; the biological, if it studies the mental processes or the states and traits of a person as a manifestation of brain function; the technological, in the analysis of the conditions and features of the labor activities of the person and of the processes of information interchange between the person and technological devices in systems of control. Other sciences are also interested in psychological investigations. Without them, for example, one cannot conceive of the development of such philosophical problems as the role of the subjective factor in history, in social organization and in control of society, or the conscious activity of a person, creative though, the role of intuition in cognition, and so on. In biology, one of the most important problems is the origin and development of the psyche. As A. N. Severtsov has shown, the psyche, which has originated in the course of biological evolution, itself is becoming the most important factor in this evolution. [2] Thus, the study of the patterns of this process unavoidably also entails the study of animal psychology. Prospects for the development of anthropology, physiology (especially the physiology of higher nervous activity) and human genetics are essentially associated with prospects for development of psychology. The growth of the role of psychology is thus connected with the logic of the development of scientific knowledge in general and, especially, with problems of social practise, which require for their solution knowledge of the mental characteristics of man. The solution of many problems of global importance, such as determination of growth potential for labor productivity, the design, development and exploitation of technology, perfection of systems of control of the economy, mastery of space, formation of the new man and special individual problems related, for example, to the design of the faces of instruments or devices for visual communication, depends on such knowledge.

It is clear that underlying various practical tasks are various psychological problems. In some cases, these are problems concerning the psychological climate in labor collectives, the characteristics of national ethnic psychology, the formation of the psychological storehouse of the personality. In other cases, these are problems relating to the emotional stability of the person, the acquisition of skills and abilities, the mechanisms of self-regulation. In still others, these are problems of perception, attention, memory and thought.

Psychology has great significance in the solution of problems involving raising the level of motivation in labor activity. Frequently a person, performing one or another task, is guided by "short term" goals, which concern only the near future. This is one of the reasons for the poor "psychological climate" in enterprises and for the rapid turnover of personnel. About 50% of this turnover has, precisely, psychological causes (loss of interest in work, dissatisfaction, etc.). In this connection, the work performed by psychologists at the Lyubertsy Rug-Weaving Combine imeni 50th Anniversary of Great October is worthy of note. The psychologists introduced so-called "personal prospects charts", which they filled out (for several years into the future) with each person who entered the work. The "chart" defined future prospective growth and the conditions under which it could take place. In other words, it helped to form "long-term" motivation. This system increased each worker's interest in his work, promoted the formation of labor collectives and decreased turnover in the work force.[3] Here, we must note the terms "motive" and "stimulus" are often confused, although they are not the same thing. A motive is an internal force of behavior which spurs a person to activity. A stimulus is an external influence. The operation of a stimulus is mediated by the person's psychology: his opinions, emotions, moods and interests. For this reason, the stimulus becomes a real spurring force only when it is transformed into a motive. A task of practical importance for psychology is elucidating the mechanisms for this transformation which must be reckoned with when systems of labor incentives are organized. Thus, for example, the re-organization of the production process at the Irkutsk shoe factory, which was performed in accordance with psychologists' recommendations, made it possible to lower the labor-intensity of work by 4.5 thousand man hours a year and to raise productivity by 16%. The psychologically-based rationalization of the run schedule for ocean going vessels effected by the USSR Ministry of Fishery Industries led to a savings of about 5 million rubles.[4] Such examples are legion. However, no one has yet calculated what losses are suffered by the state because the results of psychological science have not been adopted strongly by production.

Up to the present time, the practical work of psychologists has not been conducted systematically. Indeed, hardly 10% of our specialists are concerned with work of this sort. Furthermore, the criteria for assessing such work, the possibilities and powers available to it have not always been well-defined. In the meanwhile, the range of tasks which social practise pose for psychology is growing constantly. One foresees the need to establish a State Psychological Service in this country and to begin seriously training specialists qualified to deal with the practical problems: Psychologist-educators, psychologist-physicians, psychologist-engineers, the demand for whom has not yet been satisfied. For this reason dilettantes are not infrequently assuming the task of solving psychological problems.

When we speak of dilettantism we do not at all mean to refer to those who come to psychology from other realms of science and practical areas, impelled by the logic of their activity. We are speaking of those who set out to solve psychological problems with insufficient special training. No less dangerous are attempts to solve practical problems on the principle of "short circuiting", i.e., the direct translation of some purely scientific results (e.g., those obtained in a laboratory experiment, even a carefully conducted one) without deep analysis of their underlying principles. Furthermore, such a translation is not always possible. Attempts to solve practical problems, if they are based on individual experimental data in the absence of theoretical interpretation can lead to a result which is the direct opposite of the one intended. Human beings' real world activity (and their behavior in general) is influenced by an enormous number of the most diverse factors: the cause and effect relationships, involved in psychological processes, states and characteristics, are so complex and dynamic that the discovery of the laws governing them is very far from an easy task. This task requires a great deal of research effort, laborious analysis of the facts of real life and painstaking experimental verification of the hypotheses which have been generated in the course of this analysis and theoretical interpretation.

The psychological experiment has long been one of our most important research methods. It was formed in psychophysics and psychophysiology which are mainly oriented toward the natural sciences. But, gradually, it penetrated into other areas of psychology as well, for example, social, educational and forensic psychology.

Methods of laboratory experimentation which assure maximum control of the conditions and factors of the situation, which define the nature of the subject's task, the recording and measurement of his actions and their mathematical processing have undergone particularly intensive development. In the beginning, the laboratory experiment was structured so as to isolate and control some single determinant and to record some single phenomenon evoked by it. Effort was directed to production of one or another mental process in a "pure form." However, it has not been possible to accomplish this completely. In almost every problem results have frequently been obtained which have contradicted each other. Of course, the amassing of large data sets and the application of statistics have made it possible to discover certain stable relationships. But it is far from always possible to draw definite conclusions about the determinants involved. This situation is further complicated by the fact that some researchers attempt to exclude their subjects' subjective accounts from the analysis of results and they rely only on objective data. Meanwhile, the juxtaposition of the subjective data from an experiment with the objective might reveal much to an experienced experimentor and, in the final analysis, may be what makes knowledge of the patterns of psychology possible. Furthermore, even in a relatively simple experiment (e.g., in a reaction time experiment), similar data obtained in the study of different subjects (or even the same subjects) may turn out to result from the influence of different factors: the state of the subject at a given moment, his level of training, motivation, attitude to the task. Sometimes, when one or another result diverges sharply from the mean value, the "outlier" is more informative for psychology than is the mean value itself. Subjective factors give rise to the greatest difficulties for performance of an experiment, making it difficult to conduct it in accordance with the rigorous canons of natural sicence research. However, it is precisely these factors which should be of primary interest to the psychologist, since they make it possible, with the help of objective methods, to penetrate into the inner world of the person, the discovery of the laws of which constitutes the main task of psychological work.

The use of modern technology makes it possible not only to process data during the experiment, but also to change the action upon the subject as a function of the development of the psychological process being studied. Not infrequently, methods of the laboratory experiment are included in research conducted under conditions of the real life activity of the person.

However, the laboratory experiment is not the only way to achieve psychological knowledge. After all, not all the problems of psychology can be studied under laboratory conditions. In many cases, researchers resort to the method of the natural experiment, the idea for which was developed by A. F. Lazurskii. Such experiments are conducted in real life situations, without destroying the natural course of events.

One of the most imporatnt tasks for psychology at its current stage of development entails considering all its methods as a single system, in order to discover the decisive capability and limitations of each of them and also to find the conditions and possibilities of interchange between them as a function of the logic of the research being conducted. This entails the need for theoretical development of psychological research. In this regard, it must be remembered that the value of each theory and each method of research is determined by however good the quality and reliable are the facts it can produce.

The issue of facts in psychological science is not a simple one. It is possible, for example in a laboratory experiment, to measure accurately and reliably a person's reaction time to a given signal, to discover and rigorously describe how it varies as a function of the signal's intensity or some other features of a signal. In precisely the same manner, by designing a natural experiment in a certain way, it is possible to produce one or another change in people's behavior and to record these changes painstakingly and describe them rigorously. And in both this and the previous case, there are grounds for speaking of scientific facts. But psychology is not interested in facts for their own sakes. It must, in analyzing these facts, disclose the "inner springs" which lead to these changes, discover the dynamics of cognitive and regulatory processes, which manifest themselves in the changes in reaction time or the characteristics of change in the motivational sphere of a person, manifested through his behavior as a whole.

When a psychologist solves a problem such as this, he frequently is confronted with the truth that similar facts reflect different psychological realities while facts, which are different or even contradictory, testify to the action of the very same pattern. And this cannot be explained merely by differences in the approaches of researchers and the methods they use. The fact is that mental phenomena are themselves extremely diverse and dynamic and are controlled by complex determinants. The tasks of psychological theory also involves examining all the diverse psychological phenomena, discovering what is most essential in the development of mental functions, processes, states and features and, on this foundation, showing that certain phenomena, even mutually contradictory ones (facts of behavior, events, results) arise, under certain concrete conditions, because of the operation of a definite objective pattern.

Theoretical conceptions and schemata, which attempt to give single-valued and universal solutions, do not, as a rule, last long in psychology. They are hardly created when a mass of facts are discovered which they do not fit. Psychology needs a theory of the sort which could explain the sources of real contradictions, the bases for the qualitative transformations in human psychological development and the systemic nature of psychological phenomena and their determinants, which would examine the psychological in its dynamic complexity and understand the dialectic origin and development of many psychological phenomena.

Through the collective efforts of Soviet psychologists, a system of underlying principles for psychological science has been developed. These principles define psychology's subject, method and future program of research. In connection with the development of this system and based on it, a whole series of theoretical concepts have been created: activity (A. N. Leont'yev, S. L. Rubinshteyn), adjustment (D. N. Uznadze), systemic organization of mental processes and functions (B. G. Anan'yev), development of higher mental functions (L. S. Vygotskiy), relationships (A. F. Lazurskiy, V. N. Myasishchev), the psychophysiological bases of individual differences (B. M. Teplov, V. D. Nebylitsin), levels of reaction (K. N. Kornilov), collective reactions (V. M. Bekhterev), unity of training and mental development in the child (P. P. Blonskiy), dynamic localization of functions (A. R. Luria), generalized associations (P. A. Shevarev) and others. Investigations of sensations and perception, memory, attention, speech and thought, emotions, temperament, abilities, character, and personality as a whole have made significant contributions to the general theory of psychology.

Study of specific aspects of psychology, undertaken in various psychological disciplines, unavoidably lead to the general problems of psychology. Thus, the subject of engineering psychology is the informational interaction between man and technology in a system of regulation and control. And in recent years Soviet engineering psychology has worked on many interesting and successful projects aimed at improving the devices and operating conditions of human operators. Thus, for example, The Institute of General and Pedagogical Psychology of the USSR Academy of Pedagogical Sciences has developed a variant of an instrument panel for a chemical plant which takes into account the patterns of human input and processing of information. This instrument panel lightens the operator's task of discovering precursors to breakdowns and monitoring the course of a technological process. Leningrad University has developed principles for constructing an alphabet of symbols, has addressed several issues in the communication of spoken information and has proposed ways to represent information about spatial features of objects. Psychologists have participated in the development of an integral panel for aircraft, which has been tested successfully.[5] But, precisely because engineering psychology does not simply study the processes of information reception, by a human operator, its processing and storage, decision making and mechanisms for control of actions, but also attempts to understand the dynamics of the processes being studied, their interrelationships, the factors influencing them, the human "informational" capacities and limitations, this field must turn to the theoretical and educational results obtained in general psychology in the study of perception, memory, thinking, mental control of activity and a number of other problems. The logic of research impels engineering psychology to turn to peripheral fields of psychological science: social (for the study of joint activity of operators) and pedagogical (for the study of the process of education and training of operators).

Association between the various psychological disciplines are necessitated by the integrity of their object of their investigation. Studying the activity of a human operator in a system of control, one could, of course, be limited to only those processes by which he receives, processes and stores informations, for the assessment of his accuracy, speed and reliability. However, no matter what types of activity a person (an operator, organizer or student) is pursuing, he remains a person, with a whole system of inherent heterogeneous traits: "informational", social psychological, psychophysiological, etc. And these traits, one way or another, enter into every one of his activities, unavoidably influencing those phenomena which are being studied by a given psychological discipline.

In this connection, the systemic study of psychological traits, their objective foundations and interactions is becoming especially important. They are of great significance not only for the general theory of psychology and the special theories developed by the various psychological disciplines, but for practical concerns as well. In any event, all the special disciplines merge in the field of general psychology, which is the fundament for the whole system of psychological knowledge. Each one of the disciplines, studying something particular, also makes a definite contribution, characteristic of itself alone, to the study of the general. At the same time, the study of the particular rests on knowledge of the general.

Work on applied problems and the development of the social disciplines has enriched psychology with a set of new data, methods and ideas. Our analytic picture of the psychological has changed significantly. Thus, it has become clear that perception, which was previously considered to be a single process, really represents systems of processes which proceed at various levels and can be measured in many ways. Because of this, it becomes necessary to sort critically the multitudes of available facts on the basis of the general theory of psychology.

Speaking, however, of the present state of this theory, one cannot help but notice the "variegation", the "mosaic character" of the general picture. Dozens of concepts in the fields of perception, memory, thinking and many other problems occupy the foreground. Some of these concepts reflect general laws and characteristics of the mental, others reflect specialized forms of human activity, still others, various particular issues. The levels of abstraction and generalization in these concepts are quite diverse. One can identify at least three levels of analysis: macro-, mezo- and micro-levels.

At the macrolevel of analysis, a person is studied as a wholistic unit in the context of social life. The goal of this analysis is to investigate in what manner and to what degree the system of social relations, which has taken form in a given society at a given stage of its development, determines social adjustments, value structures, behavioral motives, the subjective field of its relationships with the environment. At this level of analysis, psychologists use such ideas as activity, consciousness, self-consciousness, personality, character, needs and capabilities. The phenomena which are reflected in them can be studied only through profound analysis of social relationships and the associations which people enter into during the process of working activity and in the process of social development. This is the case because social relationships are not something external to the person: they are formed through the actions of each concrete personality. Any activity, individual or social, has at the same time one of the modes of existence of social relationships. This is the approach, and not the approach involving abstract, broadly interpreted subjective-objective relationships, which psychology should take to this concept. Nevertheless, it is worthwhile to remember that the psychological characteristics studied at the level of macroanalysis exist not simply as a "distillation of the socium",--the biological aspect, the study of the development of the human organism, is also being taken into account.

The mezolevel (middle level) of analysis studies issues related to the functions of psychology in the life of man. Here it is important to note the following point. For a long time in psychology, there have been two extreme points of view about the mind. The proponents of one of them have denied the reality of the psychological, declaring psychological categories to be fictions. These were joined by scientists who considered psychological phenomena to be epiphenomena, accompanying the material processes taking place in the brain. The representatives of the other extreme, on the contrary, have avowed that the psychological is the only reality directly apprehendable by the subject.

Both extremes are unfounded, since psychological processes, states and characteristics are real phenomena included in the life activity of a person and fulfilling essential functions in this activity. There are grounds for speaking of the three basic functions of the psyche--the cognitive, regulatory and communicative.

The cognitive function has long and successfully been studied in the main stream of general psychology (problems of cognitive processes), educational psychology (problems of instilling and developing knowledge in students) and genetic psychology (problems of the development of the intellect). This function of the psyche has been studied by various psychological sciences at the most varied levels, from elementary sensations to the most complex forms of knowledge mastered by people in the process of development.

The regulatory function of the psyche has been studied much less. Sensation, perception, memory, thought, imagination--these are not only processes of cognition, but also regulators of human activity, the quality and efficiency of which depends in many ways on how accurately and quickly a person perceives, remembers and identifies the objects with which and among which he operates. Only in the context of the regulatory function can processes of motivation, goal setting, will, attention and the dynamics of emotional states be understood.

The indivisibility of the cognitive and regulatory functions is clearly revealed in the processes of anticipation, since these processes are developed by both the cognitive process and the process of regulation of the activity of the subject.

The communicative function of the psyche has up until now been studied very little. Not infrequently in psychological investigations, it appears to be assumed that a person is "tete-a-tete" with the physical world. The social milieu is treated as just that--a medium in which the person lives and operates. Questions of the interaction of the person with other people stay in the background. Perception, attention, thought and emotions are studied exclusively from the point of view of individual activity of people; this activity, however, does not exist in isolation, but arises only as one of the components of the joint activity of whole collectives or groups. The dynamics of human activity can scarcely be adequately revealed without taking this circumstance into account.

Interaction of people and their communication (contact) is emphasized in social psychology. However, the problem involves a broader area than this single discipline. Since it is, in essence, a general psychological problem it is also a subject for research in labor psychology, engineering psychology, psychophysics and even psychophysiology. After all, it is through communication that one-to-one relationships arise, develop and take form, that exchange of images, ideas, and interests take place, that a person's adjustment to life and the traits of his character take form, that his emotional states develop.

The functions of the psyche enumerated above are realized through a person's psychological processes and states. Now, psychology has amassed enough experimental data about the processes of sensation, perception, memory and thought. The processes of representation and imagination have been studied less. Such investigations make it possible to observe psychological processes as multilevel and multidimensional. For this reason, in each concrete case, it is important to discover under what conditions and for what reasons one or another level predominates and determines the features and dynamics of the process being studied. In research on processes of anticipation, for example, as a specific form of a defense reaction, it was discovered that these processes take place at subsensory (unconscious), sensorimotor, perceptual, "representational" and linguistic-cognitive levels. At each of these levels, the process of anticipation is characterized by a special system of specific characteristics.

At the microlevel of analysis, the neurophysiological bases (mechansims) of mental phenomena are studied. Logical analysis of mental processes and states necessitates study of their material substrate--the aggregate of the neural processes taking place in the brain. The concepts of general brain systemic processes, of the functional organ and functional systems, arose in this connection. The mental, in its relation to the neurophysiological, is now considered a systemic quality; mental phenomena are put into correspondence, not with individual neurophysiological processes, but with the mode of organizations of these processes.

This is the general scheme of the three levels of analysis. It, of course, requires further discussion and refinement, but it seems that this scheme can play the role of a sort of "scaffolding" for the construction of a general theory of psychology.

Here it is essential to take into account the fact that in the development of this theory, we must concern ourselves with the further development of its conceptual apparatus. This is necessary because, in connection with the general expansion of knowledge of psychological phenomena, when new concepts are originated, it is also necessary to define their interrelationships, the dialectics of their motion, the transitions between them. Unfortunately, until now, in the development of such categories as consciousness, cognition, personality, communication and social relationships, research psychologists frequently substitute philosophical, sociological, ethical, educational or other ideas for the psychological aspects of their research. This is why we need precise definition of those aspects of the categories which can and must be studied exclusively by psychological science and those which require joint work by psychologists and representatives of other sciences, primarily the philosophy.

One of the most responsible tasks of psychology--that of the incorporation of its discoveries into social practice--is no less important today. The means for achieving this end are various--through education, medicine, engineering developments, etc. The incorporation of the achievements of psychology into practice requires a complex research program based on systemic theory, which will also facilitate the improvement of theoretical and experimental research studies and the growth of the role of psychology in educational practice and ideological work and in the solution of the concrete problems of construction of the national economy.

FOOTNOTES

1. "Materialy XXV S'yezda KPSS" (Materials on the 25th CPSU Congress), Moscow, Politizdat, 1976, p 72.

2. A. N. Severtsov "Evolutsiya i psikhika" (Evolution and Psychology), Moscow, 1972.

END OF FICHE

DATE FILMED

3 Nov. 1981

D.D.